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Rt. Hon. REGINALD MAUDLING, P.C., M.P.,
PRESIDENT OF THE BOARD OF TRADE

who has consented to open the Mechanical Handling Exhibition (organized by this journal) on Tuesday, 3rd May next.

The Exhibition runs from Tuesday 3rd to Friday 13th May (Sunday exclusive) open daily 10 a.m. to 6 p.m.

Pour les lecteurs de l'étranger
Für unsere ausländischen Leser
Para los lectores de ultramar

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For readers overseas

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Manutention fluidifiée de la poudre d'alumine Page 126
Par: E. Buschell, A.M.I. Mech.E., A.M.I.-Inst.W., et R. C. Maskell
Il faut environ 160 000 tonnes d'alumine en poudre chaque année pour alimenter un nouveau four de fusion construit par la Canadian British Aluminium Co., Ltd., sur la rive nord du fleuve St. Laurent. Du fait que ce fleuve est gelé et fermé à la navigation normale pendant les mois d'hiver, il faut stocker à peu près 40.000 tonnes d'alumine pour pouvoir continuer d'assurer la pleine production du four durant cette période.

Application de l'energie vibratoire à la manutention mécanique Page 132
Par John D. Latham, A.M.I.PlantE., C.M.Eng., A.N.Inst.E.
L'utilisation des vibrations n'est certes pas chose nouvelle, mais l'on a progressé de manière considérable au cours de ces derni.res années. Le matériel vibratoire a les avantages d'un dessin net et de faible encombrement, d'un nombre réduit d'organes mobiles mécaniques et d'un rendement accru. Il existe plusieurs méthodes de production des vibrations, mais les deux les plus couramment employées sont le mouvement rotatif et le mouvement oscillant.

Manutention mécanique dans une nouvelle usine d'engrais Page 136
Une nouvelle usine d'une capacité de production annuelle de 75.000 tonnes d'ammoniac vient d'être mise en service par la Shell Chemical Co., Ltd., à Shell Haven, Essex. Sur cette production totale, 60.000 tonnes d'ammoniac seront vendues sous cette forme, alors que le reste, soit 15.000 tonnes, servira à la Shell pour fabriquer un engrais calcaire au nitrate d'ammonium destiné au marché anglais. Les installations de manutention pour ce produit granulé comportent un certain nombre d'aspects fort intéressants.

Manutention des stocks de sel en tas
Par J. M. Beskine, B.Sc.(Eng.) Page 138
Ce compte rendu technique décrit brièvement les méthodes de manutention des tas de stockage employées par l'Imperial Chemical Industries, Ltd., et c'est le complément d'un article sur la manutention des cargaisons de sel en vrac, publié dans le numéro de janvier de 'Mechanical Handling'. Ce nouvel exposé triate en particulier d'un système de manutention intérieur qui permet bon nombre d'autres emplois, outre la manutention du sel.

Manutention mécanique integrée chez Ford Motor Co., Ltd. Page 143
Par P. C. MacCullock
Description détaillée du système de manutention mécanique installé dans le bâtiment de peinture, finissage et montage de la Ford Motor Co., nouvellement construit à Dagenham. Les installations et le matériel en service dans ce bâtiment sont considérés comme les plus modernes du monde par la conception technique et constituent le point culminant d'un vaste programme d'expansion, comprenant la nouvelle Thames Foundry (Fonderie), des agrandissements à l'atelier des presses pour emboutir les carrosseries, un nouvel atelier de presses, un nouvel atelier d'outillage, réorganisation et agrandissement de l'usine de carrosseries, un nouvel atelier de machines à Basildon et un dépôt de pièces détachées à Aveley.

Manutention à l'aide de tracteurs industriels. 6ème partie Page 159
Par L. F. Hoefkens, A.I.Prod.E.
Dans cette sixième partie de cette suite d'articles, l'auteur traite longuement de la question de sécurité. Il fait une part importante à l'instruction et aux qualités requises des futurs conducteurs des chariots industriels automoteurs. On lira aussi dans cet article des suggestions pour des méthodes d'instruction courante.

Machine à trier la tole Page 167
On a mis au point une nouvelle machine à classer le métal pour une société américaine. Cette machine a été commandée pour essais sur une chaine complète de triage du métal, du type à avance hélicoïdale, que la société américaine fournit à l'industrie des conserves en boîtes. La trieuse est un appareil à deux postes qui, mû par signaux, sépare automatiquement les feuilles de tôle première qualité des inutilisables et les empile régulièrement sur des palettes. L'appareil est capable de manipuler les tôles au rythme de 175 à la minute.

Nouvelles de personnalités Page 169

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INHALTSÜBERSICHT AUF DEUTSCH

Förderung von Tonerdepulver Seite 126
Von E. Buschell, A.M.I.Mech.T., A.M.I. Inst.W., und R. C. Maskell
Etwa 160 000 t Tonerdepulver werden jährlich für eine neue Schmelzerei der Canadian British Aluminium Co. Ltd. am Nordufer des St. Lawrence benutzt. Da der Fluss während der Wintermonate zugefroren und für den normalen Schiffsverkehr gesperrt ist, müssen etwa 40 000 t Tonerde zur Aufrechterhaltung der vollen Produktion während dieser Monate gespeichert werden.

Die Anwendung von Vibrationskraft in der Fördertechnik Seite 132
Von John D. Latham, A.M.I.Plant.E., E.M.Eng., A.N.Inst.E.
Die Anwendung von Vibrationskraft ist keineswegs neu, aber es sind auf diesem

Gebiete in den letzten Jahren grosse Fortschritte gemacht worden. Die Vorteile der Rüttelgeräte liegen in ihrer gedrängten Bauart und kompakten Konstruktion, in der Herabsetzung der Zahl von Arbeitsteilen und ihrer grösseren Betriebswirtschaftlichkeit. Vibrationen lassen sich auf verschiedene Weisen erzeugen, werden aber am häufigsten durch Dreh- und Schwingbewegungen hervorgebracht.

Förderanlagen in einer neuen Düngemittelfabrik Seite 136
Eine neue Fabrik mit einem Jahresausstoss von 75.000 t Ammoniak ist von der Shell Chemical Co., Ltd. in Shell Haven in der Grafschaft Essex in Betrieb genommen worden. Aus dieser Gesamtproduktion werden 60.000 t Ammoniak als solches verkauft und die Resterzeugung von 15.000 t von der Shell zur Herstellung von Kalkammonsalpeter-Dünger für den britischen Markt benutzt werden. Die Förderanlage für dieses Granulat weist eine Anzahl interessanter Konstruktionsmerkmale auf.

Salzschüttgutlagerung Seite 138
Von J. M. Beskine, B.Sc.(Eng.)
Die von der Fa. Imperial Chemical Industries Ltd. angewandten Schüttgut-Lagerungsmethoden werden in diesem technischen Bericht behandelt, der eine Ergänzung eines in der Januar-Ausgabe von Mechanical Handling veröffentlichten Berichtes über die Salzschüttgutförderung darstellt. Der neue Bericht befasst sich vorwiegend mit einer Inneförderanlage, die auch für andere Waren vielseitige Anwendungsmöglichkeiten hat.

Integrierter Materialfluss bei der Ford Motor Co., Ltd. Seite 143
Von P. C. MacCullock
In diesem Artikel werden die in der neuen Lackier- und Ausstattungsabteilung der Ford Motor Co. in Dagenham installierten Förderanlagen ausführlich beschrieben. Diese werden als die modernsten der Welt angesehen und sind das Resultat eines in grossem Stil durchgeführten Erweiterungsprogramms, das u.a. die neue 'Thames'-Giesserei, Anbauten zum Karosseriestanzwerk, eine neue Presserei und Werkzeugmacherei, eine Umgruppierung und Erweiterung der Karosserieabteilung, eine neue Maschinenwerkstatt in Basildon sowie ein Ersatzteillager in Aveley umfasst.

Materialförderung mit Industriefahrzeugen, Teil 6 Seite 159
Von L. F. Hoefkens, A.I.Prod.E.
In diesem 6. Teil der Artikelserie beschäftigt sich der Verfasser eingehend mit Sicherheitsfragen. Die Ausbildung und Qualifikationen von Fahrern industrieller Kraftfahrzeuge werden besonders behandelt. Der Artikel enthält Vorschläge zur allgemeinen Durchführung dieser Ausbildung.

Blechsortiergerät Seite 167
Ein neuer Blechsortierer ist für eine amerikanische Firma entwickelt worden. Er wurde für den versuchsweisen Einsatz in einer Blechwalzmaschine bestellt, die von der amerikanischen Firma an die Konservenindustrie geliefert wird. Es handelt sich bei diesem Gerät um eine Zweistationsmaschine, die auf Signale ansprechend die einwandfreien Bleche vom Ausschuss trennt und sie sauber auf Paletten aufstapelt. Die Maschine hat eine Arbeitsleistung von 175 Blechen pro Minute.

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SUMARIO EN ESPAÑOL

Manipulacion de alumina en polvo fluidizada Pág 126
Por E. Buschell, A.M.I.Mech.E., A.M.I. Inst.W., y R. C. Maskell
Unas 160.000 toneladas de alúmina en polvo por año se necesitan para una neuva fundición construida por la Canadian British Aluminium Co., Ltd. en la ribera norte del río S. Lorenzo. Como este río se hiela y está cerrado para la navegación normal durante los meses de invierno, es indispensable almacenar unas 40.000 toneladas de alúmina para mantener en invierno la producción a pleno de la fundición.

La aplicacion de la fuerza vibratoria al manipuleo mecanico Pág 132
Por John D. Latham, A.M.I.Plant.E., C.M.Eng., A.N.Inst.E.
El uso de la vibración está lejos de ser cosa neuva, pero en los últimos años se han realizado considerables adelantos. Las ventajas de los equipos vibratorios son su construcción compacta y nítida, una reducción en la cantidad de elementos mecánicos en movimiento, y un aumento en la eficiencia. Existen varios procedimientos para producir vibración, pero los due más comúnmente se usan son los mecanismos de rotación y de oscilación.

Manipulacion mecanica en una neuva fabrica de fertilizantes Pág 136
Ha sido puesta en producción por la Shell Chemical Co. Ltd., en Shell Haven (Essex), una neuva planta cuya capacidad es de 75.000 toneladas de amoniaco por año. De dicha producción total, serán vendidas 60.000 toneladas de amoníaco como tal, y el resto de 15.000 toneladas lo utilizará Shell para fabricar fertilizante de nitrato amónico para el mercado el Reino Unido. Las disposiciones para la manipulación de este producto granulado encierran una diversidad de interesantes aspectos.

Manipuleo de grandes existencias de sal a granel Pág 138
Por J. M. Beskine, B.Sc.(Eng.)
Los métodos de manipuleo de grandes existencias de que se sirve Imperial Chemical Industries Ltd. se describen brevemente en este informe técnico, el cual es un suplemento de un informe sobre el Manipuleo de Cargamentos de Sal a Granel que fué publicado en el número de Enero de Mechanical Handling. En este neuvo informe se trata principalmente de un sistema de manipulación a cubierto que tiene muchas aplicaciones aparte del movimiento de sal.

Movimiento integrado de materiales en la Ford Motor Co., Ltd. Pág 143
Por P. C. MacCullock
Descripción detallada del sistema de manipulación mecánica instalado en el neuvo edificio de la Ford Motor Co. para pintura, acabado y montaje situado en Dagenham. Las instalaciones y equipo de que se ha dotado a este edificio se considera que son los de más avanzado diseño que existen en el mundo, siendo la culminación de un programa de expansión en gran escala del que forman parte la neuva Fundería del Támesis, ampliaciones del taller de prensas de estampado de carrocerías, un neuvo taller de prensas, un neuvo taller de herramientas, neuva disposición y amplicaión de los talleres de carrocerías, un neuvo taller de máquinas en Basildon y un depósito de piezas en Aveley.

Manipulacion con carretillas industriales. Parte 6. Pág 159
Por L. F. Hoefkens, A.I.Prod.E.
En esta sexta parte de la serie el autor trata extensamente de la cuestión de la seguridad. Reciben particular atención la capacitación de los conductores de carretillas industriales motorizadas y sus aptitudes. También vienen sugerencias para el procedimiento a seguir en la capacitación normal.

Clasificadora de chapas de metal Pág 167
Ha sido producida para una compañía de los Estados Unidos una neuva clasificadora para metal. Ha sido encargada para efectuar pruebas en una línea completa de preparación de chapas alimentada por rollos para suministro por la referida compañía a la industria conservera. La clasificadora es una máquina a dos etapas que, actuando por efecto de señales, separa automáticamente las hojas buenas de las mala, empilándolas perfectamente sobre bandejas. Su capacidad es para manipulación de hojas al ritmo de 175 por minuto.

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FLUIDIZED HANDLING OF ALUMINA POWDER

By E. Bushell, A.M.I.Mech.E., A.M.Inst.W.,* R. C. Mas ell†

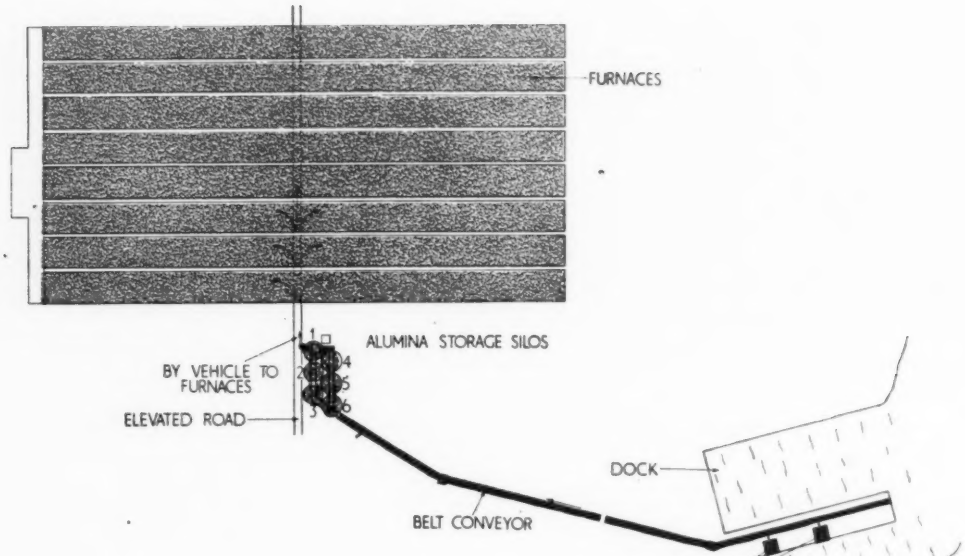


Fig. 1. *General layout of the smelter plant and alumina storage silos*

THE first ingot of aluminium was poured in December, 1957, at the new smelter built by the Canadian British Aluminium Co., Ltd., at Baie Comeau on the North Shore of the St. Lawrence River barely two years after the initial planning of the project had begun. By March, 1959, the first two stages of the smelter had been completed with a designed output of 80,000 long tons of aluminium per annum.

About 160,000 tons of alumina powder are required for this output, and this is brought by ship to Baie Comeau from various sources. Since the St. Lawrence River is frozen and closed to regular shipping during the winter months, it is necessary to store about 45,000 tons of alumina to maintain full production of the smelter during this period. The handling and storage problems arising from these requirements have been solved by an installation which is generally understood to be one of the largest fluidized handling schemes ever undertaken.

The plant was designed and built as the result of close co-operation between the British Aluminium Co., Ltd., London, C. D. Howe Co., Ltd., Montreal, Consultants to The Canadian British Aluminium Co., Ltd., and Polysius, Ltd., of Ascot, who were awarded the contract for the supply of all the mechanical and electrical equipment as well as the associated steelwork.

Fluidization methods, as applied to the handling of bulk solids, offer special advantages in the case of alumina powder. Free flow of the material can be promoted in silos, hoppers, chutes, etc., even after prolonged storage. Moving parts in the material stream can be reduced to a minimum so that heavy maintenance costs are avoided. Operation and supervision of plant can be by remote control.

The installation at Baie Comeau is based on 6 reinforced

*British Aluminium Co., Ltd. †Polysius, Ltd.

concrete silos each 65 ft inside dia, and 100 ft high which serve as storage for the alumina powder. One of the silos is of special design and serves as a loading point for battery-driven distribution vehicles which deliver the powder to the smelting furnaces Figs. 1 and 2.

The description of the plant can be divided into four major sections: (*a*) Intake of alumina for storage; (*b*) Filling service silo and extraction from storage; (*c*) Serving distribution vehicles from service silo and (*d*) Air supply and dust suppression, which—from the operational point of view—are quite separate and independent of each other.

Alumina at 400 tons/hr

Alumina which is brought up from the C.B.A. dock by belt conveyor at rates fluctuating up to 400 tons/hr is first of all discharged into a specially designed aerated distribution hopper 12 ft dia, which is installed in a steelwork reception tower, situated on the roof of silo 6. The hopper is provided with six outlets connecting to Fluidor air conveyors which in turn distribute the alumina to the various silos. Only two of the outlets are so far in use, the other four being provided to allow feeding of additional storage silos required for later extensions to the plant and installation of further Fluidors to cope with an anticipated future increase in unloading rates at the dock.

A 16-in dia overflow tube is positioned in the centre of the aerated floor of the hopper. The distance between the mouth of the tube and the floor is adjustable but is normally set at about 21 in. In the event of a surge of alumina coming from the belt conveyor the level of the fluid bed will rise and overflow through this central tube into silo 6. As an added safeguard a level controller has been positioned at a level higher than the tube, so in the unlikely event of a complete stoppage or blockage of the handling system the rising alumina will operate the controller and cause complete shutdown of the interlocked belt conveyor system and pneumatic ship discharging plant at the dock.

Flaps, each operated by a double-acting air cylinder, are fitted to the hopper outlets and at various points along the distribution Fluidors. These flaps, which direct the flow of alumina into the silos at different points, are solenoid controlled and remotely operated from a Mimic panel at a control station in the reception tower.

A layout of the silos and these distribution Fluidors are shown on the Mimic panel, Fig. 3, which allows complete control of the filling and storage operations. All the electrical switchgear associated with this section of the plant is located below the Mimic panel on the roof of silo 6.

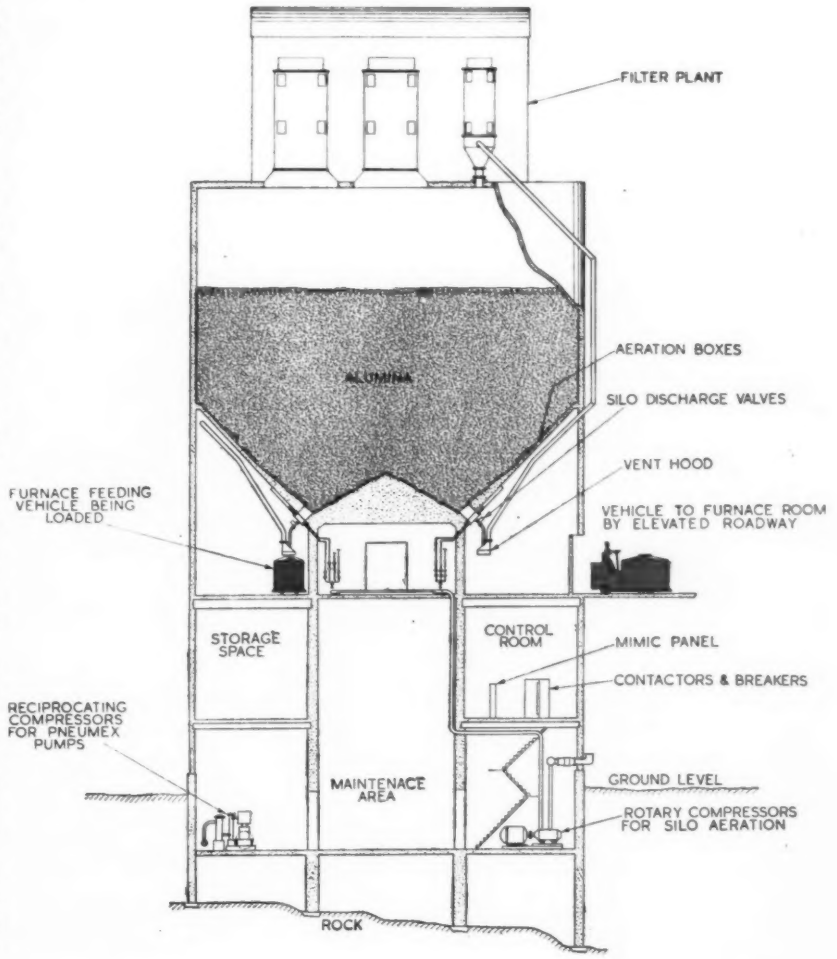
The Fluidors used for distribution are 20 in wide and consist of a lower 3-in deep flanged trough and an upper 10-in deep inverted trough. Porous tiles are bedded in rubber between the two sections, thereby forming two spaces. The space above the tile carries the alumina, whilst the space below the tile is supplied with air at 22 in W.G., provided by centrifugal blowers situated in the Fluidor galleries at intervals along the Fluidors. The Fluidors which are installed on an incline of no more than 4 per cent each achieve conveying rates of around 200 tons/hr.

16,500 ft^2 of silo floor to be aerated

It can be seen in the plan view, Fig. 7, that there are two reclaiming tunnels running along the axis of the two rows of storage silos. The West tunnel passes through silos 3 and 2, and then diagonally across to the pump pit situated at the North end of silo 4. The East tunnel also connects to the pump pit after passing through silos 6, 5 and 4. Alumina required for silo 1 is extracted from the storage silos and conveyed by Fluidors in the tunnels to the pneumatic pumps which in turn transfer the alumina to the top of silo 1.

The reclaiming tunnels measure 5 ft wide × 16 ft high in cross-section and are divided into a lower and upper section by an intermediate floor at the same elevation as the silo floor. The layout of the concrete floors of the storage silo is shown in the photograph Fig. 5. The floors are

Fig. 2. Section through silo 1 showing the service hopper and three floor levels



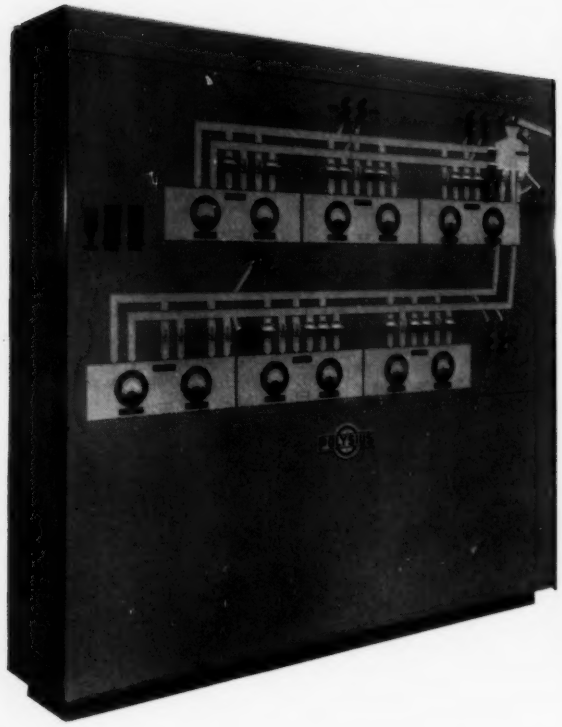


Fig. 3. View of the Mimic panel for the distribution system

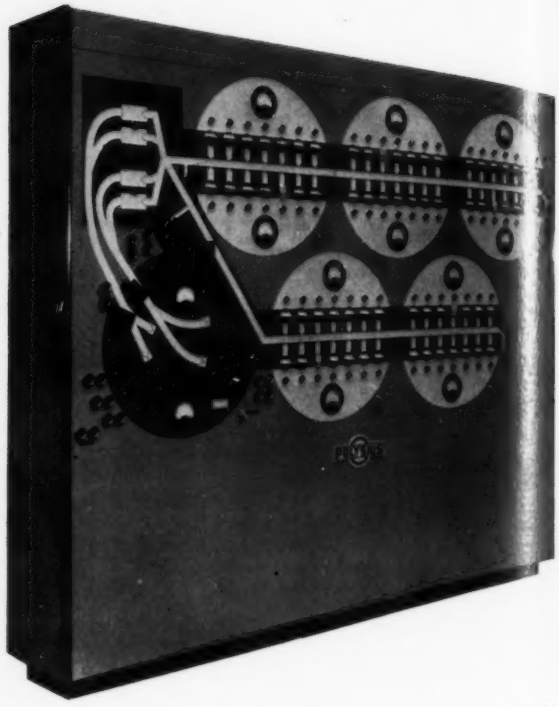


Fig. 4. View of the Mimic panel for the reclaiming system

bisected by the upper section of the reclaiming tunnel, and each half floor contains seven troughs with continuous rows of aeration boxes which are installed sloping towards the tunnel at an angle of $8\frac{1}{2}$ deg, about 15 per cent. They are used solely for the extraction of alumina through the silo outlets.

Four in mains running through the tunnels supply air to these aeration boxes via electro-pneumatic diaphragm valves which are linked in on a remote control system with the silo outlet valves. This means that when any one outlet valve is opened, air automatically flows to the aeration boxes serving the trough in question. The floor between these troughs is raised to form a ridge with the sides sloping towards the troughs at an angle of 30 deg, and further aeration boxes are installed on these slopes to provide for general aeration of the silo contents whilst the silo is not actually being emptied.

All the aeration boxes used are of a standard form consisting of a cast iron tray with a specially shaped lip in which is cemented the flat porous medium. The majority of boxes used are about 40 × 10 in, and for one silo some 440 are required providing aeration over about $\frac{3}{4}$ of the silo base area.

Simultaneous aeration of a floor of 65 ft would consume very large quantities of air, and it is for this reason that a complex system of distribution and sub-division was installed in order to reduce the air volume required in practice.

The aeration boxes on the raised sections of the floors are arranged in 12 groups to each silo, each group with an independent air supply from a 6-in main situated in the upper half of the tunnel. Air supply to these boxes is arranged through a cyclic timer operating each of 12 electro-pneumatic diaphragm-type control valves in turn. The timer works on a nine-minute period so that a complete cycle for aeration takes 108 minutes.

There are a total of 14 outlets to each silo formed by steel plates bolted to welded frames set into the concrete walls of the tunnel at the terminating point of the floor troughs. Silo outlet valves of a rubber tube pinch type, which by virtue of their special electro pneumatic operating characteristics can be set to open to a predetermined amount for controlling the outflow of alumina, are mounted on these plates.

A pipe and chute arrangement conveys the alumina from these valves to a 13 in wide Fluidor running along the lower tunnel, also at a slope of 4 per cent, to the Pneumex pumps situated in the pump house to the South of silo 4 and alongside silo 1.

Each of the two Pneumex pumps installed in the pump pit comprises two pressure vessels. These vessels, which have a porous floor, are alternately filled and emptied to allow for continuous pumping. While alumina is being discharged from one vessel the other is being filled. When the alumina level reaches a certain point during the filling period the vessel is closed and compressed air is introduced through the floor which forces the now fluidized alumina through the delivery pipe to the inlet points in the roof of silo 1, a vertical ascent of approximately 125 ft. The operation of these pumps is fully automatic and each has an operating capacity of 30 tons/hr. Provision is made for adjustment of the air/alumina ratio during conveying in order to reduce as much as possible the relative velocity in the line. This results in an overall increase in efficiency of the pumping operation and reduces internal wear in the pipes.

The changeover of flow from each vessel to the forked

ABOVE
Fig. 5. Aerial view showing the floor of a storage silo under construction

LEFT
Fig. 6. View along the upper half of a reclaiming funnel

conveying pipe is controlled by valves similar to the silo outlet valves which avoid the use of mechanical changeover devices prone to heavy wear when handling alumina. The pumps are operated from the second Mimic panel which is situated in the control room within silo 1. Over-riding controls are provided at the pumps.

Silo 1 with four floor levels

It will be seen from Fig. 2, that the floor of silo 1 is of a conical shape and this is suspended at a very much higher level than the floors of the storage silos. In the space below three horizontal floors have been constructed for other purposes. The upper of these floors is at the same elevation as the floor of the furnace room and it is here that vehicles are charged with alumina. Part of the intermediate floor is occupied by the main control room whilst the lower floor or basement, which is reached by a staircase adjacent to the control room, is utilized as a compressor room.

Although differently arranged, the general principle of fluidization is also applied to the conical floor of silo 1. Separate aeration boxes are provided for the discharge of alumina and for general aeration. A cyclic timer is provided to carry out successive aeration of 12 sections as is the case with the storage silos.

There are six vehicle filling points situated approx 7 ft above floor level each with a valve and dust control hood. After positioning his vehicle under any one of the outlets the driver presses a button; this opens the filling valve, turns on air to the relevant section of the silo and simultaneously initiates suction in the dust control hood. When the vehicle is filled another push-button closes the system.

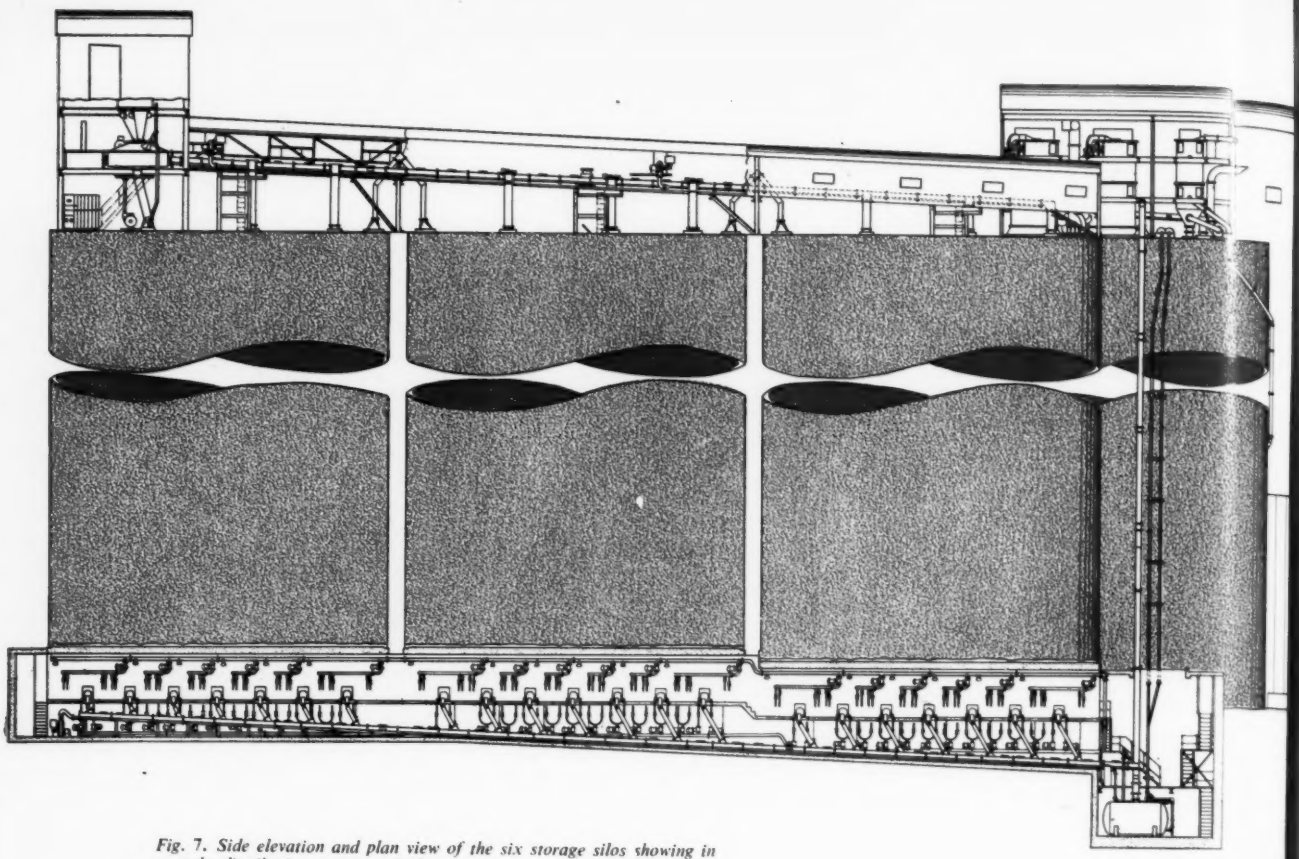
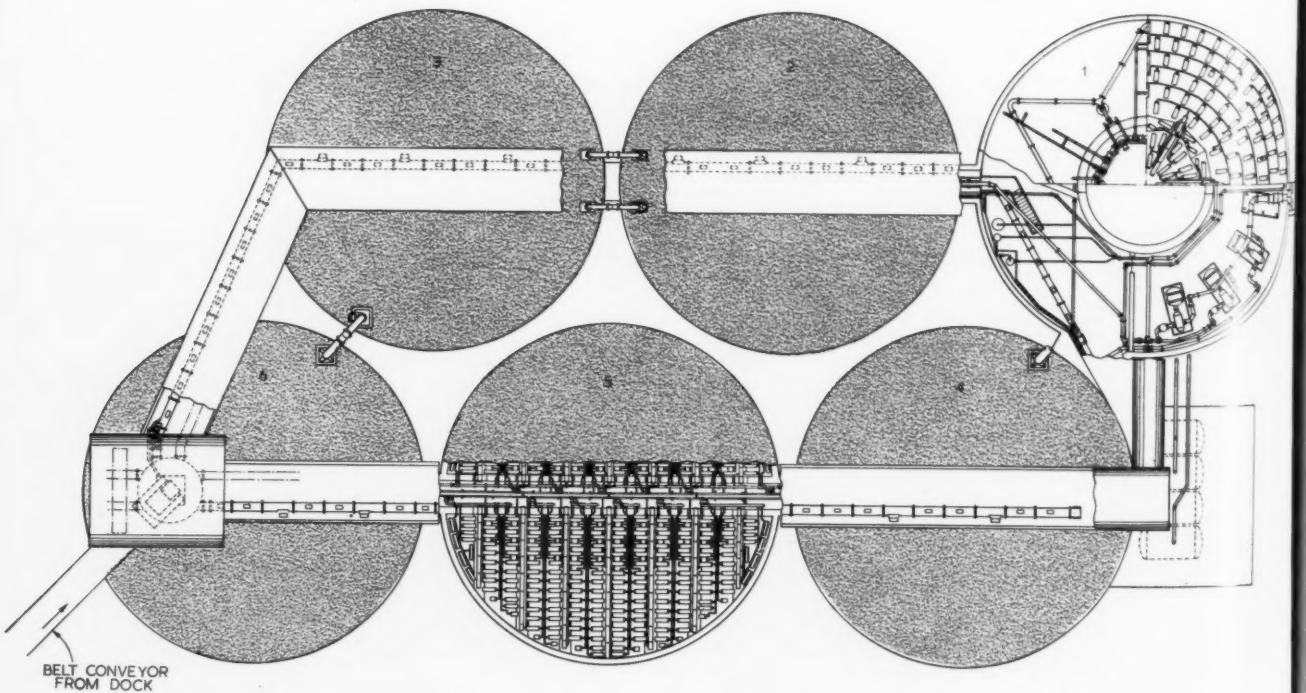


Fig. 7. Side elevation and plan view of the six storage silos showing in part the distribution system and silo aeration



In the compressor room, six rotary floating vane-type compressors are provided for supplying the air for silo aeration. Three of these deliver 700 c.f.m. each at 25 p.s.i. for general aeration, whilst the other three deliver 200 c.f.m. each for aeration of troughs during the extraction of alumina.

For the Pneumex pumps, two reciprocating compressors each giving 485 c.f.m. at 45 p.s.i. are installed. All the instrument air required within the silos is provided at 100 p.s.i. by one of two small reciprocating compressors. Special oil and water separators are fitted on the delivery mains from all compressors whilst the intakes are protected by dry fabric cell-type filters.

In a plant of this nature the large quantity of air used for conveying purposes must be collected and cleaned before discharge to atmosphere. For this purpose three dry fabric filters were installed in a specially constructed building on the roof of silo 1. Two of these are of the bunker type arranged for direct suction through openings in the silo roof. These filters can handle a maximum air volume of 16,000 c.f.m. This allows all the dusty air released by the Fluidors, the discharge from the Pneumex pumps and air displacement from the storage silos during filling, to be dealt with. All storage silos are, for this purpose, connected to silo 1 by inverted 'V'-shaped ducts situated in the roofs. The third filter, which is somewhat smaller, provides for suction at the vehicle filling points and handles the air taken in at the dust hoods. Dust collected in this filter discharges through a flap valve back into silo 1.

While silo-filling operations are controlled from the Mimic panel in the reception tower, all other operations carried out in the silos are controlled from the second Mimic panel which is situated in the control room below silo 1. This panel, Fig. 4, shows a complete layout of the extraction and transfer system and contains all the switches necessary for operation of the compressors, Pneumex pumps, Fluidor blowers, silo outlet valves and filters. Various signal lights show the equipment in operation, and illuminated arrows indicate the pipelines, valves and conveyors actually handling material.

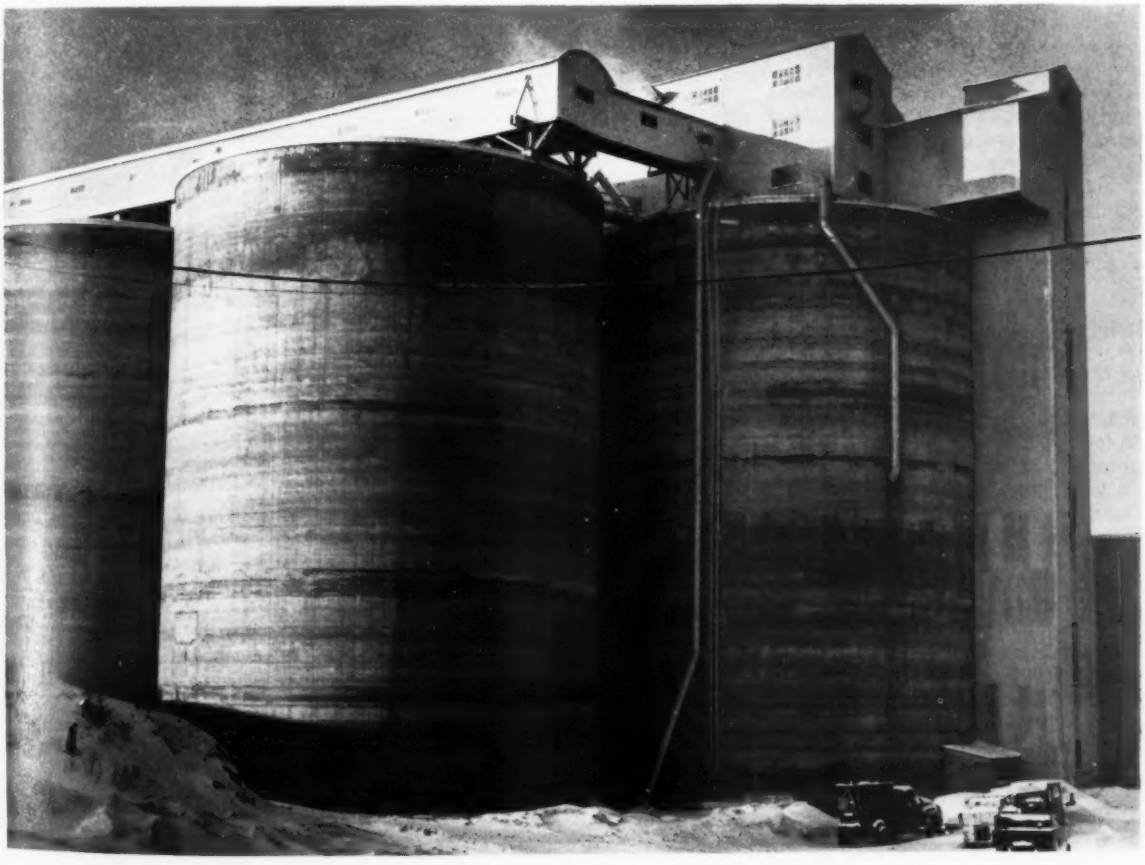
The main breakers and distribution panels for this section of the plant are also accommodated in this control room. Continuous level indicating equipment used to show the depth of alumina stored in the silos is connected to give simultaneous readings on both Mimic panels.

A passenger elevator running up the well of a covered stairway near silo 1 gives access to the service floors of silo 1 and the filter building above the silo, and doors provided in the roof of each silo allow access by means of a man-hoist even during the severest winter weather.

The filter building, reception tower and interconnecting galleries are clad with 'Alochromed' corrugated aluminium sheeting.

It is perhaps of interest that the supply and erection of this plant—among other things—called for the shipment of 260 tons of structural steelwork, 2,500 aeration boxes, 18,500 ft of $\frac{1}{2}$ to 6-in piping and nearly 1,000 valves of different types.

Fig. 8. General outside view of the silos from the side of silo 4



THE APPLICATION OF VIBRATORY POWER TO MECHANICAL HANDLING

By John D. Latham, A.M.I.PlantE.*

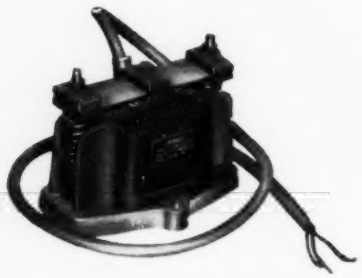


Fig. 1 (*above*). *A typical vibromotor of* 500 *watt capacity*
Fig. 2 (*left*). *A light-duty electromagnetic vibrator*

THE employment of vibration in mechanical handling engineering is by no means new; however, its developments during the last few years have been tremendous. The advantages of vibratory equipment are compactness and neatness of design, a reduction in the amount of mechanical moving components and increased efficiency. There are several means of creating vibration but the two most commonly used are rotary and oscillating motions. Rotary motions are generated by means of eccentrics rotated about shafts, and oscillating motions are, in the main, those generated by electromagnets. An examination of the majority of vibratory equipment available reveals that it is the two mentioned systems of generation that are employed to impart a directional motion through the unit to the material being handled.

The rotary generated vibratory power is not as easily variable regarding frequency and amplitude as electromagnetically produced motions which can be altered in output characteristics while operating. Therefore, the rotary units which run at a constant frequency are not generally used where a sensitive controllable force is required. One of the most versatile means of applying vibration is by means of a Vibromotor or, as it is sometimes called, clamp-on external vibrator. These are self-contained rotary vibrators in which the eccentric masses are placed on the actual rotor shaft, the stator of the motor forming the outer casing to which the fixing attachment is mounted and the unit being, therefore, totally encased. These units are available from 50 to 1,500 watt capacity and enable an efficient source of vibratory power to be applied very easily to trouble spots on hoppers, storage bins and the like, where they will overcome arching and in general improve the flow of materials from the container. It is this type of application which favours the rotary motions as, generally speaking-there is no need to vary the amount of vibratory power once the installation is in operation.

An interesting development based upon the Vibromotor application is the vibrating membrane which can be installed inside of a concrete or solidly constructed structure to assist in output flow of materials. The membrane consists of a steel plate about 25 sq. ft. which is mounted on rubber strips against one or two faces of the inside of the bunker. Holes bored through the structure allow special laminated springs attached to the underside of the plate to pass through and be connected to a steel sub-frame which is suspended from them. To this a Vibromotor is attached. When operated, the motor sets the membrane plate 'alive' with vibrations and moves the material laying upon it.

*Vibration Manager—Winget, Ltd.

Fig. 3. *Application of two vibromotors to a steel hopper to improve output and prevent arching*

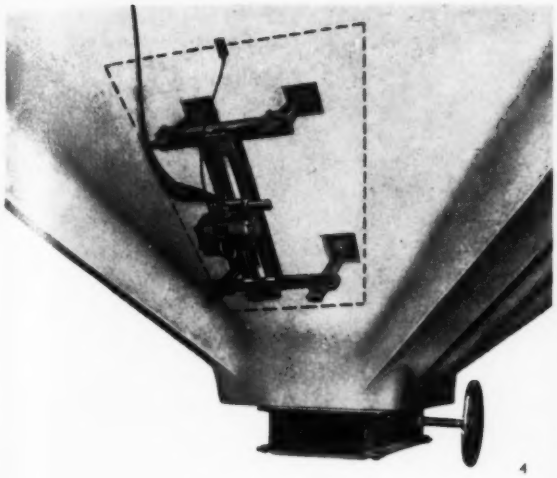


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Fig. 4. Exterior view of a vibratory membrane assembly fixed in a concrete hopper

Fig. 5. A battery of vibratory chutes each of which is powered by a vibromotor

Fig. 6. A small hopper-fed vibratory feeder

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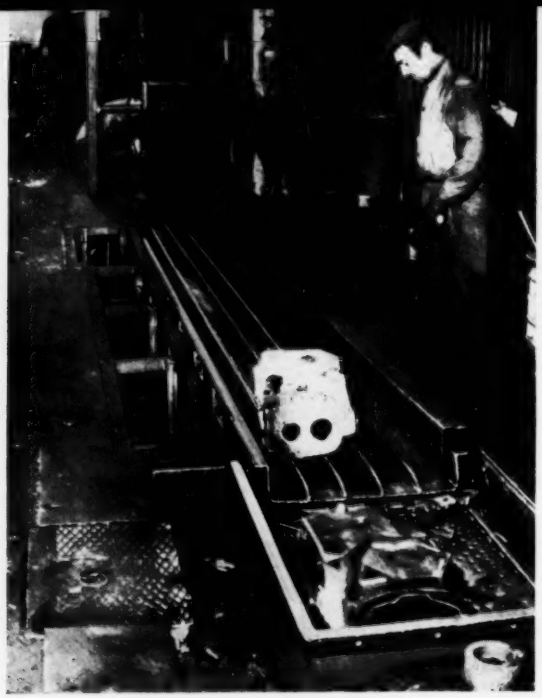
Progress with designs of Vibromotors have caused changes to be introduced on certain types of vibrating screens. A design of suspension screen is now available which is entirely self contained and free of any external moving parts due to the incorporation of a Vibromotor in its design. Vibrating screens normally employ totally enclosed eccentrics running between heavy-duty bearings or on earlier models, open rotating masses, but in either case powered by an electric motor and vee belt or similar type of drive. The self-contained suspension screen will offer tremendous advantages, as installation in difficult locations will now be readily available.

Of similar construction to the suspension vibrating screen is the vibrating chute. This resembles a steel trough fitted with spring suspension devices under or above which is mounted a Vibromotor. Again, as with the suspension screen, limitations are found for size and capacities that can be handled.

The vibrating feeders, incorporating within the design electromagnets, enable an extremely accurate and sensitive control of flow of materials to be experienced. A control box, embodying half-wave rectification and voltage control, enables an operator of a vibratory feeder to vary or stop the flow of material in a fraction of a second. This type of equipment therefore lends itself readily to automatic weighing and batching equipment where by means of relay switchgear, complete automation in material flow is established.

Vibratory conveyors offer to industry new fields of thought as it is now possible for dual operations to take place simultaneously in one conveying machine. Material can be fed into a vibratory conveyor and during its passage have removed from it oversized or undersized materials or have faulty component parts rejected during motion. This is achieved by incorporating in the design of the transport trough a section acting as either a screen or rejector. Vibratory conveyors can again be powered by either the rotary or oscillating motions, but if a rotary motion is employed a slightly more complex design is required as it is not possible to get the desired resultant motion to the material to be transported simply by clamping a Vibromotor to the underside of the trough. Either a system of directional thrust springing or dynamically opposed rotors must be employed to ensure that a motion is obtained in the conveyor section which gives the desired result. Variations on the vibratory conveyor are tube transporters, trough conveyors, totally enclosed rectangular sectioned transport tubes, each of which can show advantages over conventional conveyor systems. The one point, however, which limits their use in certain applications is the low angle of inclination which restricts considerably the upward transporting of materials.

The vibratory spiral elevator and the bowl feeder are striking examples of the developments that have taken place to assist in the upward carrying of materials by vibration.



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These units, although limited at present in size and capacities, are available to carry out several functions. They can be used as pure materials lifting units or fitted with a rejector, to reject as the discharge point over feed or faulty material. A further variation, where component parts are handled, is to reject any component not fed out in the required manner, i.e., if handling bottle tops, one passing in the reverse position to that desired is rejected. Again, these units can be incorporated in fully automatic plants.

The vibrating table is probably one of the earliest introduced vibratory products, originally brought in to

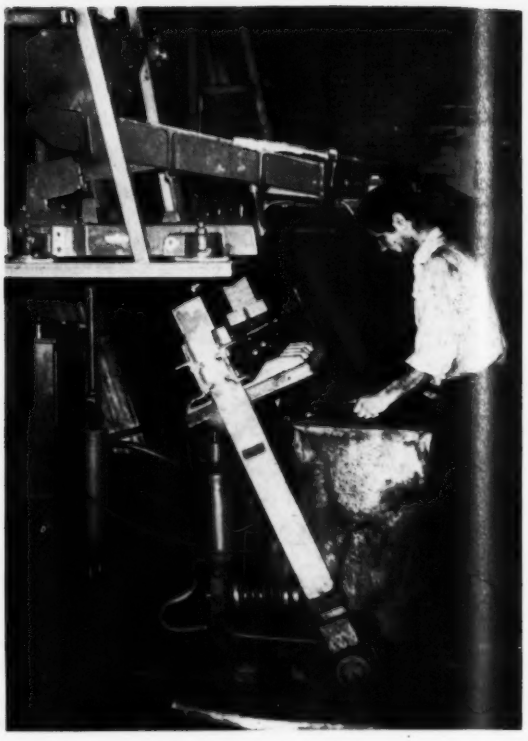

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Fig. 7. Heavier-duty electromagnetic powered vibratory feeders handling foundry sand

Fig. 8. Vibratory conveyor handling castings in foundry

Fig. 9. Vibratory table mounted with top flush with floor

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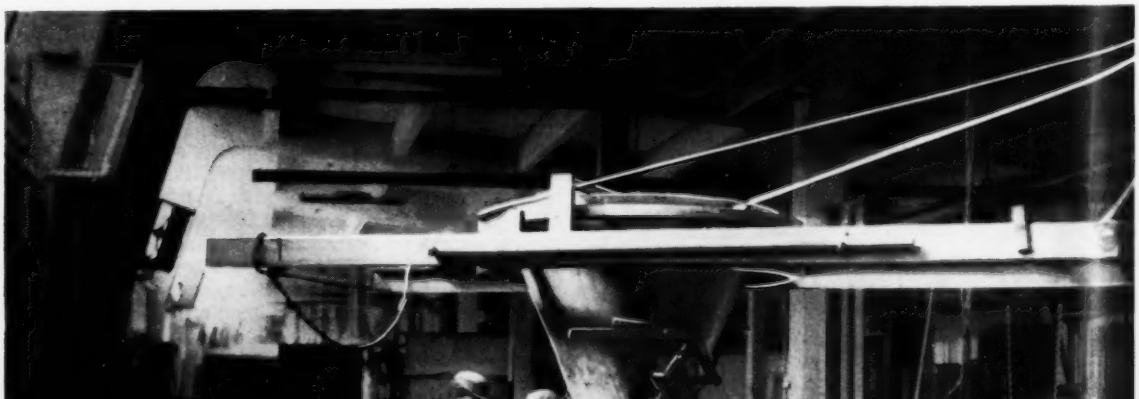


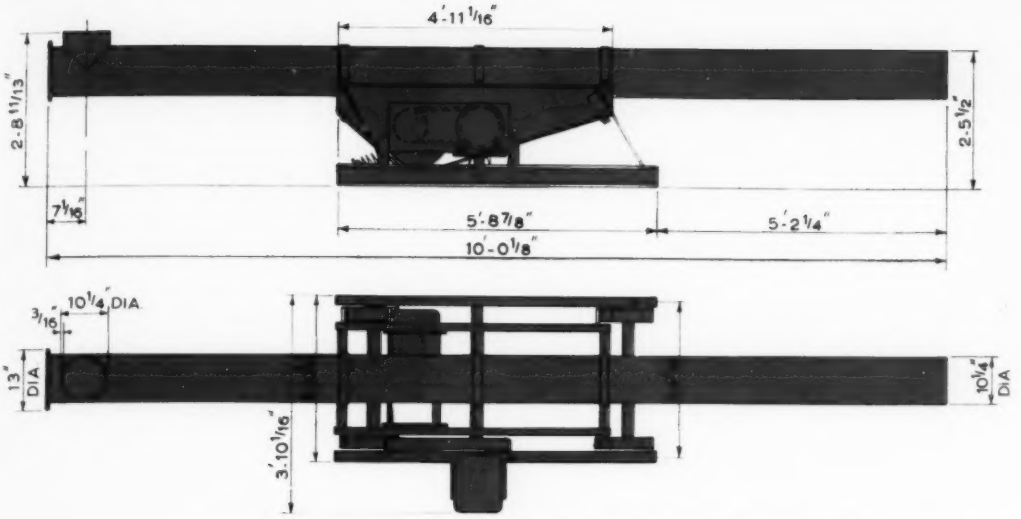


Fig. 10. Main dimensions of a vibratory tubular conveyor type MD31-0·5 × 1·5

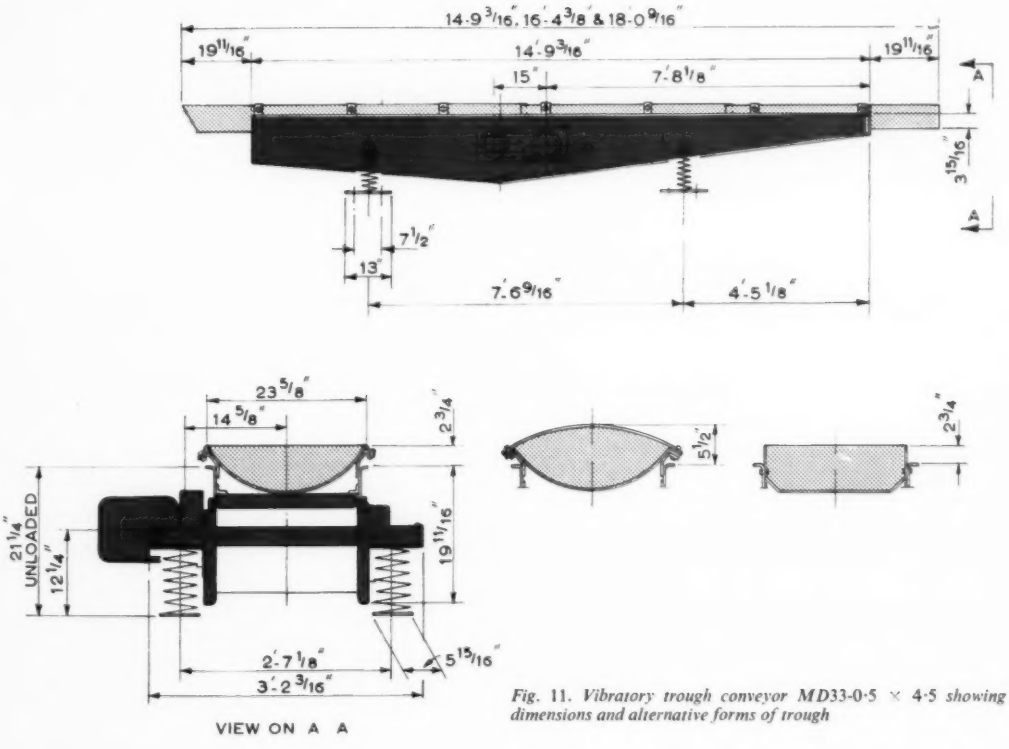


Fig. 11. Vibratory trough conveyor MD33-0·5 × 4·5 showing overall dimensions and alternative forms of trough

assist in the making of precast concrete products, although used for many years in the foundry trade. It has also found its way into the general industry and now specialized machines such as automatic sugar bag fillers, chemical powder packers, canned food packing machines, etc., include in the filling section of track, a small vibrating segment, which in effect is a miniature vibrating table.

Although the range of vibratory mechanical handling equipment available is large and its use in the industry in general is at present only a fraction of its potential, as yet not every material responds favourably to the vibratory handling equipment available. Typical examples are cement or other powder materials in which it is essential for an air content to be maintained to obtain the natural lubrication for flow of the material, however research work is in progress to assist even in this type of difficult handling by the application of vibration.

Photographs in this article are by Winget, Ltd., Rochester; A.B. Vibro Verken, Stockholm, and Vibro Plus Products, Inc., U.S.A.

MECHANICAL HANDLING AT NEW FERTILIZER PLANT

by J. Grindrod, B.A.(Com.)

BUILT on the basis of knowledge and experience gained in ammonia production both in the United States and Holland, a new plant with a capacity of 75,000 tons of ammonia a year has recently been placed in production by the Shell Chemical Co., Ltd., at Shell Haven, Essex. Of this total production, 60,000 tons of ammonia will be sold as such and the balance of 15,000 tons will be used by Shell to manufacture ammonium nitrate/chalk fertilizer, or 'Nitra-Shell' for the U.K. market. The handling arrangements for this granulated product includes a number of interesting features.

'Nitra-Shell' is prepared from chalk and ammonium nitrate manufactured from the ammonia and nitric acid produced at Shell Haven. Its manufacture, which operates at a constant rate throughout the year, involves features that differ very considerably from those of other Shell chemical plants in that the handling of large quantities of solids is involved. In the design of the plant great emphasis has been laid on mechanical handling and automatic control. The drying and powdering of chalk and the sizing of 'Nitra-Shell' granules inevitably creates dust and great attention has therefore been paid to removing dust from all gas and air streams before they are discharged to the atmosphere.

Wet chalk is delivered by road and dumped directly into the boot of a bucket elevator which transports the chalk to a belt conveyor. The latter delivers the chalk to a storage hopper from which a screw conveyor transports it to the atritor, where it is ground and dried. The hot gases used for drying the chalk carry it forward to a cyclone, where the dry powdered chalk is knocked out and carried forward to the dry chalk storage-hopper. The gas stream from the cyclone is freed from chalk fines by passing through a bag filter.

The chalk from the dry chalk storage hopper is carried by a screw conveyor to a second hopper, where it is joined by the fines removed in the bag filter, and then transported pneumatically to the hopper from which it is fed to the process.

Gaseous ammonia from the synthesis unit is neutralized in the saturator by nitric acid from the ammonia oxidation plant. This reaction releases a considerable amount of heat and causes most of the water to vaporize and leave the system as superheated steam. From the saturator ammonium nitrate containing a little water flows to the concentrator where most of the latter is flashed off under reduced pressure, and the almost water-free ammonium nitrate passes to the mixing granulator, where it is joined by a mixture of powdered chalk, 'Nitra-Shell' fines and crushed over-size 'Nitra-Shell' particles. From the granulator the mixture flows as a semi-plastic mass to the rotary drier where the 'Nitra-Shell' particles are completely dried and assume their characteristic spherical shape. The particles are then screened to remove oversized lumps and are lifted by a bucket conveyor to a double-deck sieve where final grading is accomplished. The optimum particle size is about 2·5 mm in diameter and oversize particles are crushed and, together with undersize particles, fall to the recycle conveyor which carries them back to the granulator. The correctly graded product is carried by a vibrating conveyor to the powdering drum where it is mixed with the total dry chalk flow delivered from the dry chalk hopper. The powdered granules are separated on a final sieve from the bulk of the chalk which is then carried by the recycle conveyor to the granulator. The finished 'Nitra-Shell' granules are cooled and de-dusted and lifted by the final product elevator to a belt conveyor which transports them over a totalizing weigher to the storage building. The air used in the de-duster passes through a cyclone to knock out entrained chalk which is discharged to the recycle conveyor, and finally through a water scrubber before discharge to atmosphere.

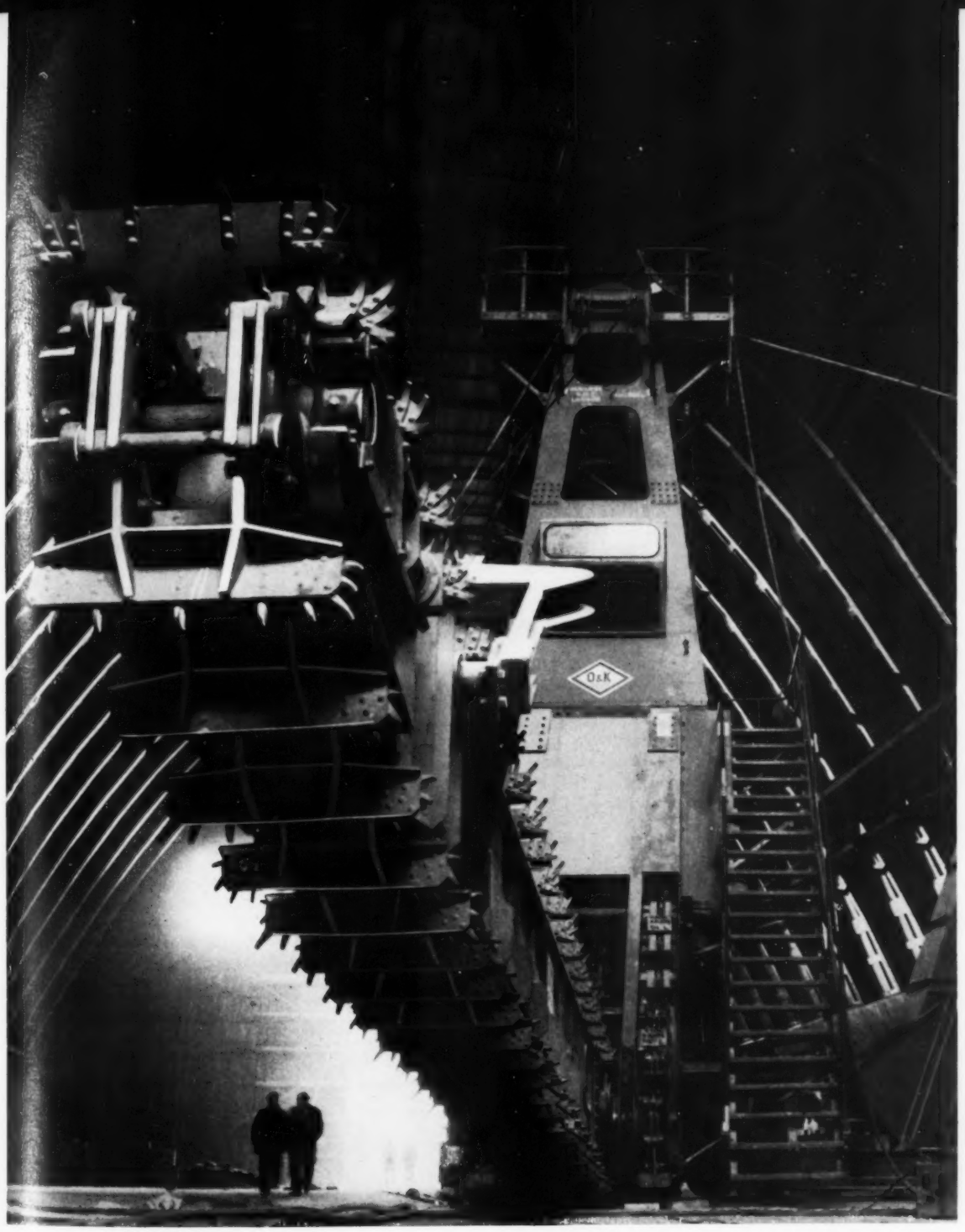
Of parabolic section, the 'Nitra-Shell' storage building is 300 ft long, 100 ft wide and 65 ft high. In order to cater for off-season storage the capacity of the building is 20,000 tons, the 'Nitra-Shell' being stored loose, in bulk. Stocks will also be stored in depots in many parts of the country. In view of the hygroscopic nature of ammonium nitrate, it is essential that the 'Nitra-Shell' storage building should be waterproof and this has been accomplished by covering the concrete structure with a layer of bitumenized felt.

'Nitra-Shell' enters the storage building on a conveyor leading from the production building and is transferred to the product distribution conveyor which runs the whole length of the building under the apex of the roof. A movable tipper is provided so that the 'Nitra-Shell' can be discharged on either side of the belt at any position along its length.

The 'Nitra-Shell' is delivered to the bagging section by a harvester. This has a rake jib which can be moved through 270 degrees in a horizontal plane and also is capable of being elevated. The jib is set against the side of a pile of 'Nitra-Shell' and draws the product to a secondary elevator which lifts it further into a hopper. From this the fertilizer discharges to a belt conveyor which feeds another elevator which in turn discharges through a hopper on to the collection conveyor.

Capable of moving the whole length of the building on a rail track, the harvester can reach all the material in the store. All movements are controlled from a sealed dust-free cabin in the machine which is continuously supplied with fresh air.

The collection conveyor discharges on to another conveyor which carries the 'Nitra-Shell' to the main storage hoppers in the bagging building. These are two square vessels divided by a central wall, and each section has four conical outlets which discharge to individual weighing machines. They have a capacity of 1 cwt discharge at the rate of five discharges a minute. From the weighing



The harvester used for delivering 'Nitra-Shell' to the bagging section of the plant at Shell Haven

machines the product is taken to the bag-filling machines and thence to rail or road loading conveyors.

The automatic equipment is fully served by inter-locking safety devices and alarms and the whole operation can be carried out with a minimum of supervision and labour.

The main suppliers of equipment for this new Shell Haven plant are as follows:—

Elevators and belt conveyors, Spencer (Melksham), Ltd.; **vibrating conveyors,** Owl Engineering Supplies, Ltd.; **weighing machines,** Richard Simon & Sons, Ltd.; **chalk conveyors and atritor** (crushing and drying equipment), Alfred Herbert, Ltd.; **rotating dryer,** Manlowe Alliott & Co., Ltd.; **cooler-deduster,** Lurgi; **granulators,** Taylor Reid & Co., Ltd.; **grizzly screens,** G.E.C.; **bag filters,** Visco Engineering Co., Ltd.; **filling machines,** Sack Fillers, Ltd.; **bulk product handling machine,** Orenstein & Koppel, Ltd.

BULK SALT STOCKPILE HANDLING

by J. M. Beskine, B.Sc. (Eng.)

STOCKPILE handling methods employed by Imperial Chemical Industries, Ltd., at their Runcorn Salt Works, Cheshire, are briefly described in this *Mechanical Handling* Technical Report, which supplements a report on Bulk Salt Cargo Handling published in the January issue of this journal. This previous technical report on bulk salt handling featured a new ship bulk loader, designed and installed by Crone & Taylor (Engineering), Ltd. The present report deals mainly with another Crone & Taylor installation, an indoor system which is worth general attention by mechanical handling engineers because of its applicability to other bulk materials and because of its all-round economy and low first cost.

The scheme is interesting because it was considered, after an evaluation of many alternative schemes, to be the cheapest and most effective method of storage in a 50-year-old wooden warehouse designed for entirely different bulk handling methods. The particular problem which faced the designers was how to store the maximum volume of salt with a minimum of equipment in a relatively wide warehouse of low head room. The solution which was obtained required only nominal structural modifications to the warehouse; it was particularly suited to blend in with the methods of recovery (already described in the previous report) and may have relevance to a much wider range of bulk handling problems. It employs a simple cross-conveyor, which can be obtained to any length to suit the span of warehouse bays in a given building. It also uses a reversible shuttle conveyor, which, too, can be obtained to any reasonable length. This shuttle conveyor is provided with a suspended rotatable thrower at each end. By traversing or reversing the shuttle conveyor, the entire warehouse can be covered from either of the two throwers.

At Runcorn, this handling system is installed in a two-bay warehouse and a shuttle conveyor 104 ft in length is employed. The total capacity is not very large, being only

Fig. 1. Cross-section through I.C.I. warehouse at Runcorn Salt Works, showing layout of Crone & Taylor cross-conveyor and location of chutes from centrifuges, and reversible shuttle conveyor

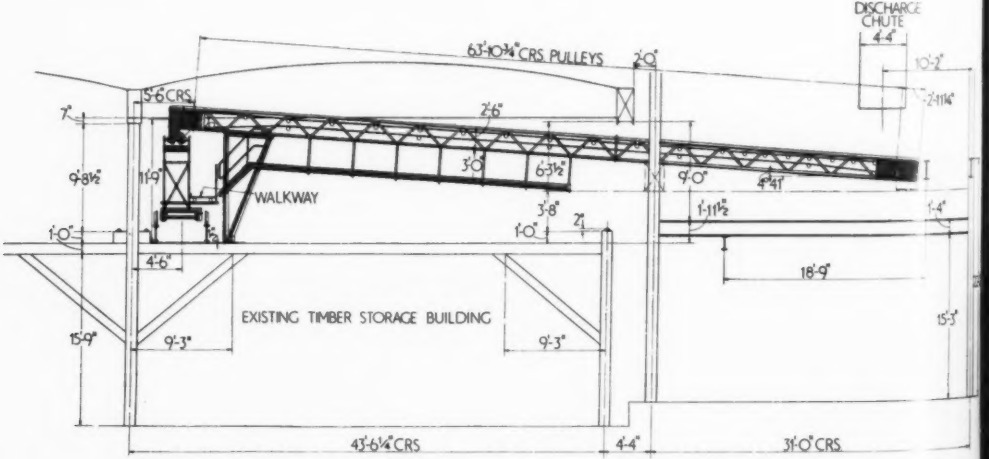
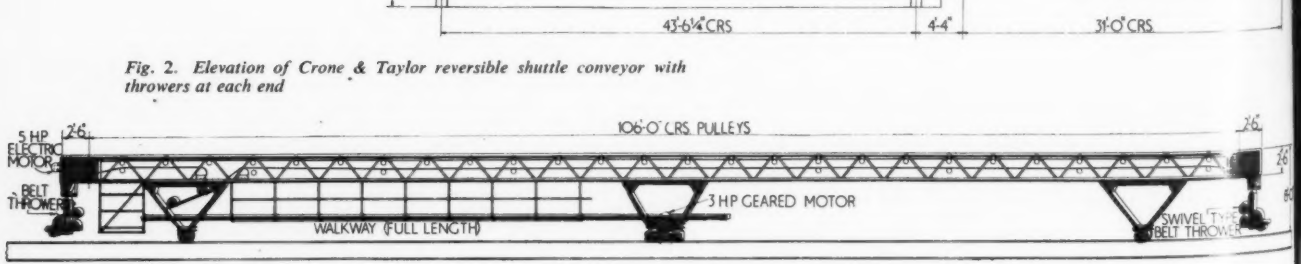


Fig. 2. Elevation of Crone & Taylor reversible shuttle conveyor with throwers at each end



20 tons/hr. This capacity corresponds to the output of the centrifuges, which deliver the salt to the warehouse, and is all that is required in this particular warehouse. Similar equipment could be designed to suit much larger handling rates.

Basic Layout of the Handling Scheme

The basic layout of the indoor handling system at Runcorn is shown in the drawings, Figs. 1 and 2, details being shown in the photographs Figs. 3, 4, 5, 6, 7 and 8. Fig. 9 shows a general view of a ship alongside the wharf, with the warehouse building in the right-hand rear portion of the photograph. The difficulty of obtaining wide-angled detailed photographs of the conveying gear is, in a way, a tribute to the efficiency of the Crone & Taylor design, this difficulty being due to the successful way in which practically the whole of the 'air rights' in the warehouse have been used for stockpiling, a bare minimum of installations and working room being necessary for the actual handling equipment which was easily accommodated in the space within the roof construction.

The warehouse building is 300 ft long × 90 ft wide and consists of two bays, each of which is covered by a Belfast roof. The shuttle conveyor is mounted in the roof space, and the rotatable centrifugal throwers, at either end of this conveyor, can radiate their throws of salt to spread it into either bay of the warehouse. The shuttle conveyor is shown in Fig. 2, and in Figs. 3, 4 and 8. The throwers are shown at work in Figs. 6, 7 and 8.

The cross-conveyor which delivers the salt on to the shuttle conveyor, is shown in Figs. 1 and 4.

Design and Construction

The Crone & Taylor stockpile handling installation at Runcorn deals with 20 tons/hr of undried vacuum salt (sodium chloride, i.e. table salt) of approximately 3 per cent moisture content. The salt is fed to the warehouse from centrifuges which discharge vertically on to the cross-conveyor through timber chutes. Brief details of the design and construction of the three sections of the installation, (*a*) cross-conveyor, (*b*) main shuttle conveyor, (*c*) throwers, are given below.

The cross-conveyor is 68 ft long between centres, and is fed with salt from the two discharge chutes shown in Fig. 1. It uses a conveyor belt of 18-in-wide duck and rubber,

Fig. 3. View of shuttle conveyor in roof space of the warehouse, and, in foreground, top of salt stockpile between cross-beams of the warehouse structure

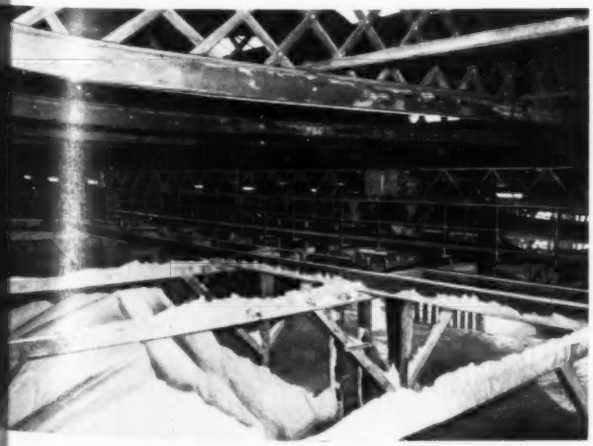


Fig. 4. View along gangwalk of shuttle conveyor and, to right, delivery end of the cross-conveyor, with top of salt stockpile below

with 4-ply 28-oz cotton duck covered by $\frac{1}{8}$-in rubber topping and $\frac{1}{32}$-in rubber bottoming, grade A rubber being used. This conveyor belt runs at 200 ft/min and is vulcanized endless. The drive is from a 5-h.p. electric motor, through a Vee-drive and torque arm speed reducer mounted on the drive pulley shaft. A power-driven rotary nylon brush is arranged beneath the belt to keep it clean and prevent any accumulation of salt. The conveyor structure consists of tubular steel beams which span the centrifuge bay and the first bay of the warehouse, access being provided by a timber walkway fitted to the side.

The main shuttle conveyor is 104 ft long between centres. It has a conveyor belt 18 in wide and to the same specification as that of the cross-conveyor, running at 200 ft/min and reversible. The driving unit is a 5-h.p. electric motor, working through a Vee-belt transmission and torque arm speed reducer on the driving pulley shaft. The main frame of the conveyor structure is of tubular steelwork, and there is a walkway on one side along the full length of the conveyor. Local maintenance platforms are provided to facilitate inspection and operation of the throwers. The shuttle conveyor as a whole is mounted on three sets of bogie wheels, one of these being driven by means of a 3-h.p. geared motor unit.

The cross-conveyor discharges the salt through a hopper and chute, on to the shuttle conveyor. The overall length of the warehouse is 300 ft and the shuttle conveyor can move backwards and forwards, a distance of about 96 ft, in either direction, in order to enable one of the two end throwers to get within working range of any required section of the warehouse.

Each of the two throwers has a 12-in-wide belt, which runs at a moderately high speed, and enables a maximum throw of approximately 40 ft to be obtained, inclined at slightly above the horizontal. Motors of 5 h.p. are employed, working through Vee-belt transmissions. The framework of each thrower is suspended from a ball-bearing rotating turntable ring which gives a rotation of approximately 300 deg. Feed chutes are of mild steel, vitreous enamelled for resistance to corrosion and wear. Thrower rotation is hand-controlled from the access walkway of the shuttle conveyor. The thrower once positioned can be left for

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several hours to discharge into any particular sector of the warehouse.

The idlers of the conveyor and thrower belts are of the grit-proof sealed ball-bearing type, vitreous enamelled for corrosion resistance. All shaft bearings are sealed and provided with detachable plastic shields. The tubular steelwork is protected against corrosion attack by painting with red lead paint and then taping with special adhesive tape designed to withstand corrosive attack. The corrosion-resisting tape is then finished with a normal multi-coat paint finish. The steelwork is provided with a special anti-corrosion paint protection.

Throughout special attention has been paid to provision of mechanical safety requirements, using British Standard 2890 as a basis. For example, all drives and belt nips are fully guarded. And, electrical sequence control is provided to prevent the feeding of material on to a stationary belt.

Particular attention has, in fact, been paid to electrical design and construction. This aspect of the installation is of particular importance because of the possibility of corrosive attack on electric conductors and joints, and the possibility of flashover or electrical leakage due to the possible presence of salt-laden moisture in the air and on the surfaces of metallic parts and insulating materials.

For these reasons, in view of the severe operating conditions, all enclosures of electrical gear are of heavy-duty cast iron of the weatherproof type. The interwiring of main, auxiliary and control circuits is in P.V.C. insulated single-wire armoured cables and in P.V.C.-sheathed overall cables. A multi-core pliable-wire armoured cable, carried on a spring-loaded reeling drum, is used to feed power to the shuttle conveyor from a central outlet point. The wiring sub-contractor for the installation was S. H. Heywood & Co., Ltd., of Manchester.

Fig. 5. Salt stockpile from ground floor level of warehouse. The ground marks were made by four-wheel drive loaders

Fig. 6. Crone & Taylor thrower at end of reversible shuttle conveyor, discharging salt on to the stockpile. The maximum throw of this machine is 40 ft

Fig. 7. View of thrower from ground level, showing also, the relatively small space in the roofspace, occupied by the salt-handling plant

Fig. 8. View along top of salt stockpile, with thrower at work and shuttle conveyor, right

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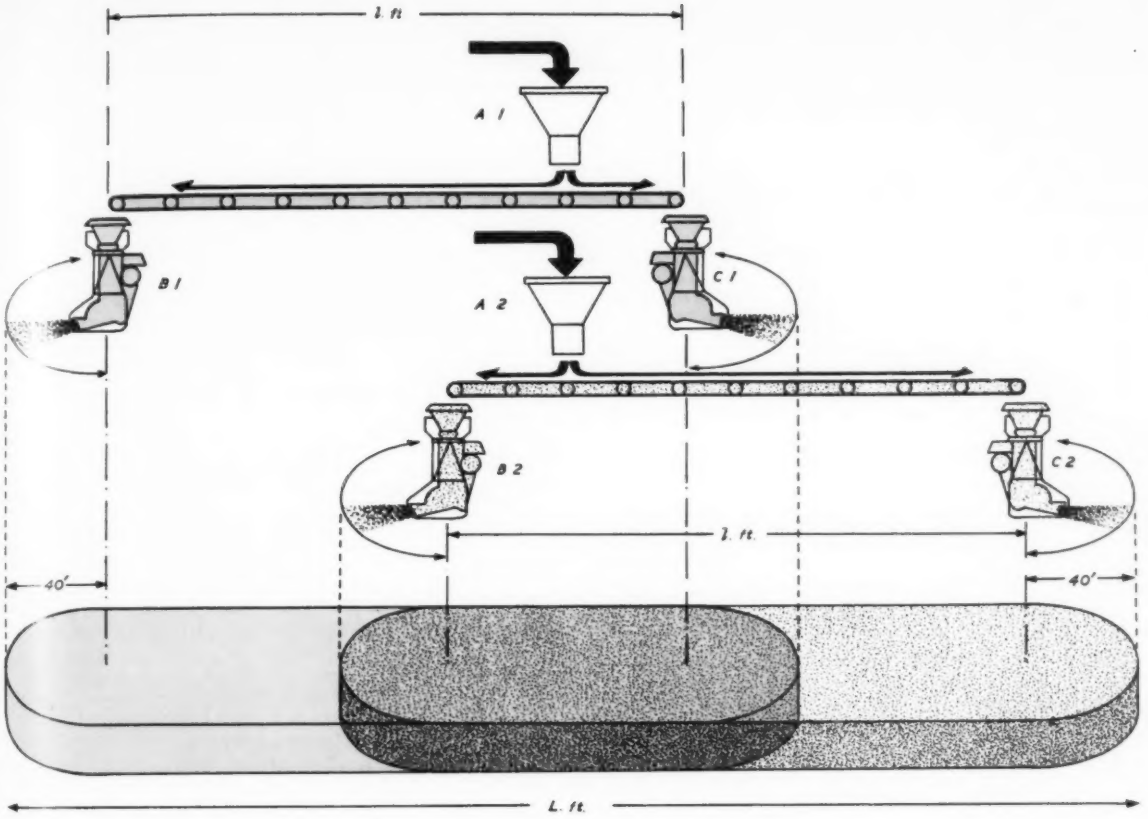


Fig. 9. General arrangement of cross-conveyor, with reversible shuttle conveyor in extreme right-hand and extreme left-hand positions, respectively, showing maximum volume within which stockpiling can occur. The minimum ratio of l to L, shuttle conveyor length to stockpile length, is 50 per cent very approximately, for installations of this kind

Two electrical safety systems are employed. Firstly, a proved earth system is used. Due to the severe operating conditions a monitored earth system is provided for the shuttle conveyor and for the two throwers. Earth continuity is kept constantly checked by this means. Secondly, the ancillary equipment is protected by use of direct-push emergency stop switches. In addition, rope-operated switches are provided, to enable all moving belts to be readily and instantly stopped. Limit switches are mounted on the shuttle conveyor to prevent this from over-running its track.

General Applicability of the Shuttle Conveyor and Thrower Handling System

The diagram in Fig. 9 illustrates the general application of a Crone & Taylor reversible shuttle conveyor and thrower installation for stockpile handling, as at the I.C.I. Salt Works, Runcorn. At this salt works, salt reclaimation from the stockpile is carried out by means of large four-wheel drive hydraulic loaders, as described in a previous technical report. However, other methods might be used.

In the diagram the cross-conveyor or feeder conveyor is shown twice, at A_1 and A_2. The reversible shuttle conveyor is shown in its two extreme positions at B_1 C_1 when in the extreme left-hand position, and B_2C_2 when in the extreme right-hand position. In any position, either thrower can project a 300 deg. arc of salt of radius 40 ft. Consequently, the stockpile volume which can be filled by means of both throwers, is one contained within, but not completely filling, the volume bounded by the shaded and coloured areas shown in Fig. 9. The overlap between the left-hand end of the shuttle conveyor when in the right-hand extreme position, and the right-hand end of the shuttle conveyor when in the left-hand extreme position, i.e. the distance B_2C_1, is necessary to enable one cross-conveyor to service the shuttle conveyor in all positions, and to ensure that the over-lapping arcs of throw of the two throwers completely service the central portion of the stockpile volume.

As can be seen, the total length of shuttle conveyor, *l* ft, is of the order of not less than one-half of L ft, the total length of the stockpile. It can of course, be somewhat greater. The actual ratio of *l* to L is based upon economic considerations, such as comparisons between economies due to using a shorter shuttle conveyor, as against using a slightly longer conveyor and reducing the travel between extreme positions. In any case, it would appear that important cost economies may be obtained, as compared with the use of a full-length conveyor and a ploughing-off system, provided that the overall length of stockpile, or the overall width, is not too small for this type of installation.

Crone & Taylor, designers and manufacturers of the installation, claim that their type of shuttle conveyor with throwers at its extremities, is one of the most economical stockpiling systems obtainable and that it compares more than favourably in first cost and in running and maintenance costs, with any other type of stockpiling equipment, including the use of conveyors and throw-off gear of the travelling belt plough type. This claim does appear to be strongly substantiated from examination of basic principles of design.

In addition to reduced first costs, other advantages require

consideration, for example, ability to occupy a very minimum of headroom, simplicity of control and flexibility. Furthermore, this type of handling equipment is applicable to a large range of bulk materials, including coal and coke as well as all kinds of raw materials and chemicals which are suitable for handling in the open air, e.g. sugar and phosphates.

Another important consideration is that of the cost of the warehouse or bunker installation. This type of stockpiling installation lends itself very well to use with an open stockpile or with a stockpile under the simplest of cover, such as a large shed, or in the case of coal or coke might possibly be used with considerable advantage in conjunction with overhead bunkers. This could be on the grounds of reduced cost: (*a*) reduced handling installation cost, and (*b*) reduced bunker installation cost.

Strictly speaking, overhead bunkers are only necessary (*a*) where a continual feed of material is required, (*b*) where gravity flow is regarded as compulsory, and (*c*) where space considerations prevent employment of ground-level bunkers and elevators. Nevertheless, it is felt that in many cases, unnecessarily high first costs are entailed as a result of failing to challenge bunker design fashions which have not changed materially for half a century or more.

A case could be made out for ground-level bunkers, or semi-open stockpiles, with built-in conveyor feeders to processing plant, using orthodox troughed belts, zipper-type belts or box-section troughed belts. And, in such a case, one might expect to see really important savings in first cost of construction, due to use of concrete-sided ground-supported bunkers or bunker-type stockpiles, dimensions large enough to usefully employ a shuttle conveyor and thrower installation. In fact, in some cases, one might in this way eliminate one handling operation as well, that of outdoor stockpile handling prior to indoor bunker handling.

AGGREGATE CLAIMED FROM THE SEA

For many years, hydrographers have said that a vast stream of sand and gravel moves continuously from west to east along the north side of the English Channel and in 1946 a company was formed with the object of using this source to extract concrete aggregates from the sea.

The first task of this company—the South Coast Sand and Ballast Co., Ltd., a subsidiary of Wm. Cory & Sons, Ltd., was to locate an area which could be regarded as a natural reservoir of material fed by the littoral drift. A shoal area south-west of the Needles was proved for this purpose and for more than 10 years an expanding fleet of vessels has been extracting material of a consistent quality without affecting the sea bed.

The principal advantage of winning aggregates in this way is that large quantities of material can be carried economically to all ports on the south coast of England. Depots for marketing these aggregates have been developed and acquired at several south-coast ports in Britain where grading plants and other necessary equipment has been installed.

A screening and storage plant made by Frederick Parker, Ltd., was erected in Southampton Docks in 1947 to be followed by a second at Leamouth Wharf, Southampton. There are similar Parker plants at Twyford Wharf, Portsmouth and Pottery Quay, Plymouth, and a further plant for Southampton has just been purchased.

At Portsmouth, the material is unloaded from the ships and fed to an 'Oscillex' horizontal vibrating screen set above the storage bins for $1\frac{1}{2}$, $\frac{3}{4}$, $\frac{3}{8}$ and $\frac{3}{16}$ in materials. The plant grades about 40 to 50 cu. yd./hr and this material is used in local building operations and in the company's own ready-mixed concrete plants.

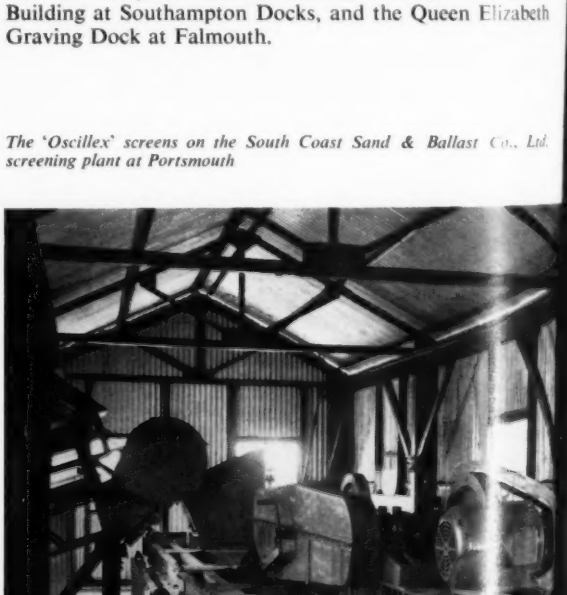
The 'Oscillex', made by Parkers,is a two-tray counter-balanced horizontal screen designed to handle large capacities and gives accurate screening at low operating costs. The two trays are independently mounted and the movement of each is opposed to the other to cancel out the forces set up by each tray.

The company's Plymouth grading plant is very similar to the one at Portsmouth, and material from this plant is being used extensively in the rebuilding of Plymouth and on the new Tamar Bridge.

To supply material for its plants the South Coast Sand and Ballast Co., Ltd., has built up a fleet of suction dredgers managed by an associate company, the South Coast Shipping Co., Ltd. The earlier vessels in service were converted coasters, but the latest vessels have been specially designed and built for the traffic.

Among the projects for which South Coast Sand and Ballast have supplied material for concrete construction is the Car Ferry Terminal at Dover, the Ocean Terminal Building at Southampton Docks, and the Queen Elizabeth Graving Dock at Falmouth.

The 'Oscillex' screens on the South Coast Sand & Ballast Co., Ltd. screening plant at Portsmouth



INTEGRATED MATERIALS HANDLING AT THE FORD MOTOR CO., LTD.

By P. C. MacCulloch

'UNHAMPERED handling and the smooth flow of materials were the dominant thoughts in the minds of the planners from the beginning, and this consideration largely determined the design of the building'—*Ford Bulletin*, November, 1959.

The above quotation aptly summarizes the background to the planning, design and arrangement of the mechanical handling systems installed within the Ford Motor Company's new paint, trim and assembly (P.T.A.) building at Dagenham.

This building, its plant and equipment, is considered to be the most up-to-date in design in the world and is the culmination of a large-scale expansion programme costing £75 million including the new Thames Foundry, extensions to the body-stamping press shop, a new press shop, new toolroom, rearrangement and extension to body plant, the new machine shop at Basildon and a parts depot at Aveley.

The P.T.A. building is the largest single item of this programme and accounts for some £11 million of the total investment. The site area of 48 acres is that of the old sports field adjacent to the former Briggs Motor Bodies Plant, now the Ford Body Group. In this area a building of approximately 1,215 ft long × 630 ft wide has been erected, consisting of a ground floor for trim, assembly, storage and sales preparation operations and a first floor of 437,000 sq. ft. given over to all painting operations.

The mechanical handling systems installed in the P.T.A. building were devised as an integral feature of the whole project. Basic aims were to ensure a flexible, continuous flow of car bodies from the main Body Group building through the various painting processes, from there through trimming operations, followed by final assembly and sales preparation.

It also provides for the movement of body models in separate lines where this is necessary, as one continuous flow where this is desirable and the 'feed in', at selected points, of the numerous components and sub-assemblies in the trimming and assembly operations.

Above all, the systems had to be capable of great flexibility of control with regard to speeds, off-line storage runs, raising, lowering and turning of the bodies, in progress storage lines, and the marrying up of the varying fixed-conveyor installations and the services provided by the mobile equipment of fork trucks, tugs and trailers, etc.

Not only must the whole materials handling arrangements be flexible but, in an undertaking of this size, it must be capable of very fine control. Without the facilities available to register immediately any change in schedule, hold ups, damage, etc., in the system and instigate remedial action, taking into account the effect on all previous and subsequent operations, production would rapidly become chaotic, with a consequent loss of thousands of pounds, of manhours and lost production.

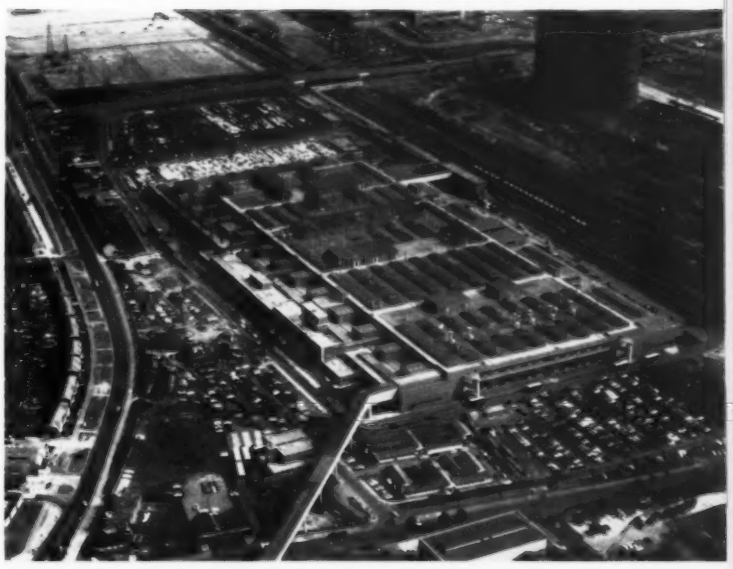


Fig. 1. Aerial view of the new P.T.A. building showing the conveyor bridge from the Body Group building

In order to meet these requirements it can be appreciated that nothing could be left to chance, to be worked out after installation of equipment. Planning of the mechanical handling systems had to be based on certain fixed objectives within the overall plan of the whole project.

It was early in 1955 that Ford's planning engineers began setting out the requirements of the new P.T.A. building layout and operations and, after evolving their main requirements as to the handling methods desired, called in the equipment suppliers' engineers to work out the details.

These suppliers, in close collaboration with Ford engineers, built at their works full size prototypes of their conveyors and with practical checking and testing, using sample car bodies, proved that the system would meet the requirements of the Ford planners. The illustration at Fig. 2 shows the work-flow movement within the two floors of the new building.

Work Flow in the Paint Shop

The diagram at Fig. 3 shows a simplified version of the layout and work flow of car bodies undergoing painting. The bodies are brought from the Body Group building through a conveyor bridge; this in itself was a major

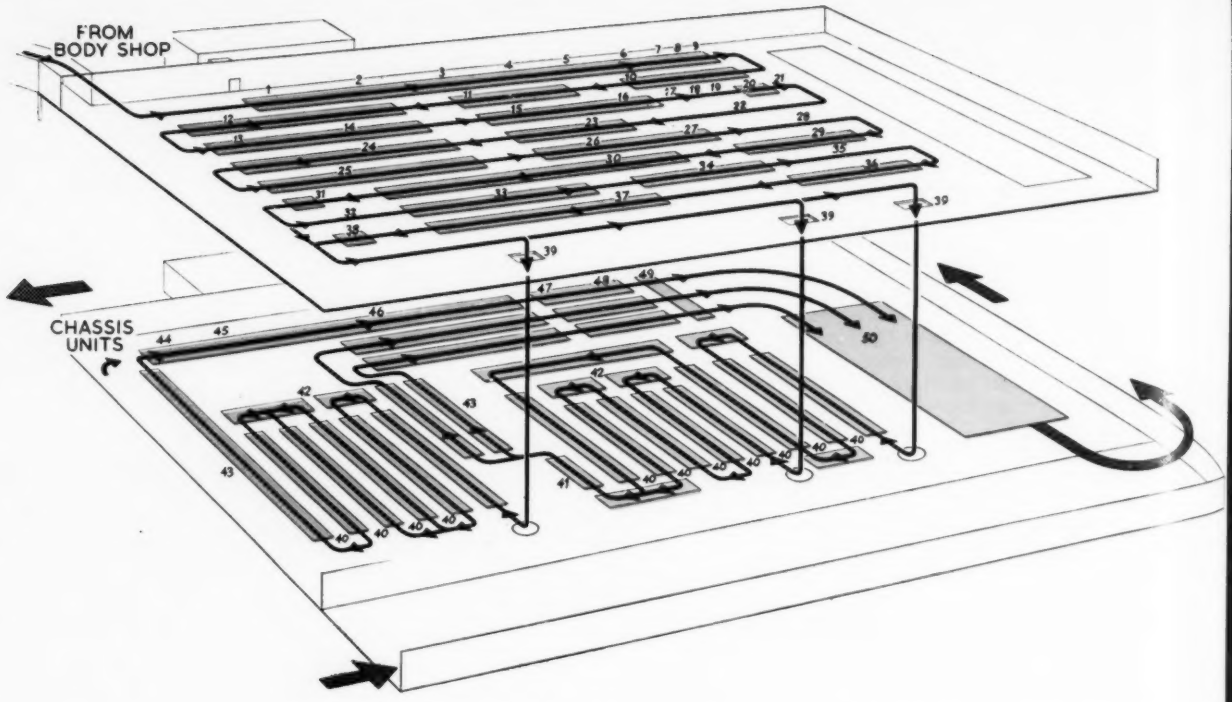
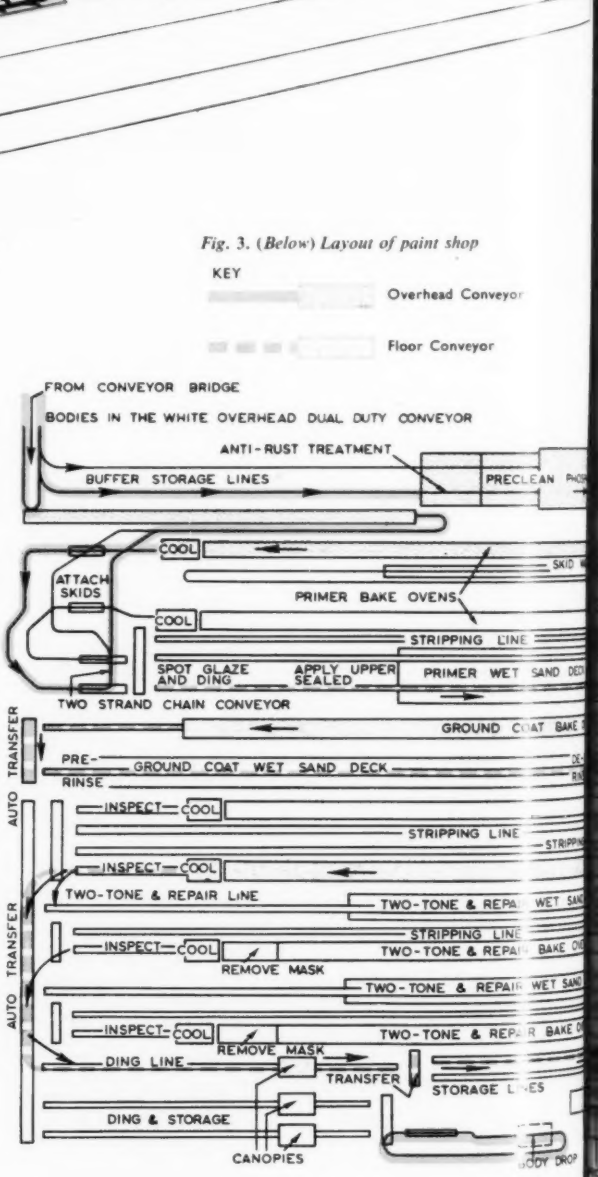


Fig. 2. Illustrates the work flow movement within the two floors of the new building

KEY

1. Anti-mist pre-clean
2. Phosphate system
3. Auto blow-out
4. Phosphate dry-off ovens
5. Metal glaze
6. Apply upper sealer
7. Air dry glaze
8. Sand glaze
9. Tack wipe
10. Slipper dip system
11. Primer spray booth
12. Primer bake oven
13. Spot glaze
14. Apply lower sealer
15. Primer wet sand deck
16. Wet sand dry-off oven
17. Inspect
18. Prime
19. Pick-up
20. Spot spray
21. Flash blow-out
22. Regulating lines
23. Ground coat spray
24. Ground coat bake oven
25. Ground coat wet sand deck
26. Wet sand dry-off oven
27. Cool
28. Buffer storage
29. Final enamel spray booth
30. Final enamel bake ovens and stripping lines
31. Cool
32. Regulating lines
33. Two-tone and repair wet sand deck
34. Wet sand dry-off oven
35. Masking line
36. Two-tone and repair spray booth
37. Two-tone and repair bake oven
38. Cool
39. Body drops
40. Trim lines
41. Storage
42. Transfer
43. Crossfeed
44. Engine dress
45. Suspension
46. Final assembly
47. Toe-in
48. Escalator
49. Roll test
50. Minor repairs / Export preparation / Domestic preparation

Fig. 3. (Below) Layout of paint shop



engineering project being 725 ft long, with internal dimensions of 18 ft wide by 10 ft clear minimum height. The whole length is specially insulated with 2-in thick wood-wool slab in order to prevent condensation affecting the metal-finished unprotected bodies.

The method of transfer through the bridge is by overhead dual-duty chain conveyor with the 'in-white' car bodies suspended on specially designed slings. On entering the paint shop the bodies are automatically indexed into either one of two storage lines, Fig. 4. This parallel two-line arrangement is an essential feature of the whole layout of the paint shop as will be seen by reference to the diagram.

The following brief description of the sequence of operations applies equally well to both systems. The body shells are withdrawn from the buffer storage lines as required and all shells of the six different models, Popular, Anglia, Prefect, Consul, Zephyr and Zodiac undergo the following processes:— 1. pre-clean and spirit wipe; 2. six-stage phosphate (bonderizing); 3. auto blow-off; 4. phosphate dry-off oven; 5. cooling; 6. water and dust sealing and metal glazing (upper parts); 7. slipper dip (underbody painting); 8. primer spray booths; 9. primer bake ovens; 10. cool.

Up to and including this last stage of cooling, all processes on the body shells have been performed with the shells still suspended on slings and passed by the overhead conveyors through the various booths and ovens, etc. As can be appreciated, there are a variety of time durations for each process, e.g. phosphate coating, primer coating, etc. and careful planning of the length of the booths and timing of the conveyors had had to be ensured. Excepting the buffer storage conveyor lines at the beginning of the process which are timed at 20 f.p.m. the remainder of the system is regulated to an average of some 10.8 f.p.m.

The transfer between the conveyors is entirely automatic. For example, the body shells are fed alternately into the two buffer storage lines at the beginning of the painting process. If, due to subsequent processes, one line is held up, all bodies from the Body Group Plant are fed into the other line until that in its turn is filled, whereupon the main conveyor is automatically stopped.

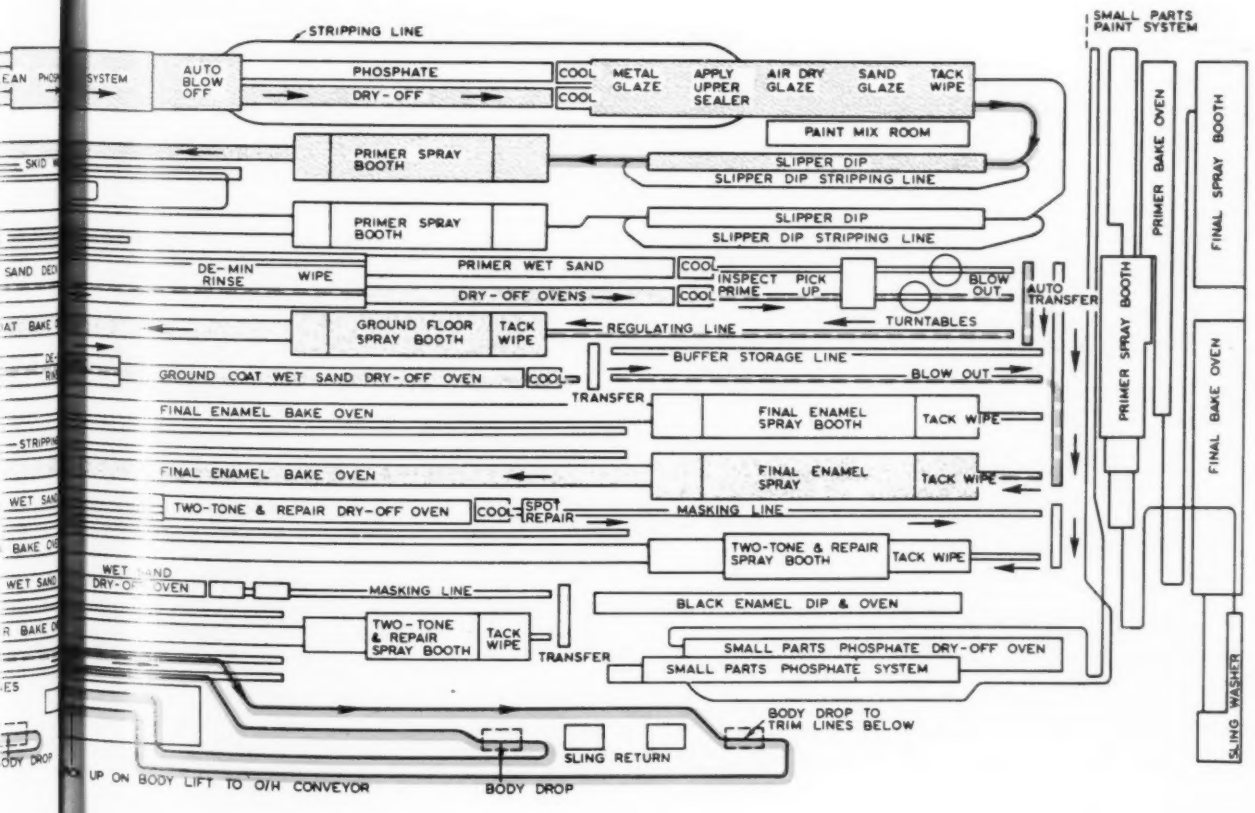
Bodies are drawn on to the conveyor line feeding the phosphating machine by an empty pusher dog on the return strand of the conveyor, and the vacation of the indexing position on the storage line will allow the movement of all body shells banked on that line.

Restarting of the main transport conveyor is automatic when the last indexer, a device for stopping and starting a loaded trolley without stopping the conveyor itself, on either storage line becomes vacant.

All movement of the body shells between these overhead conveyors is controlled by call switches operated by the body sling of the shells. Thus the shells are called in at pre-set intervals by the movements of the preceding shell and conversely, held, if that call switch is not tripped.

In order that the speed of each conveyor is synchronized with the requirements of the varying processes, transfers between conveyors, and the overall schedule of all the painting operations, each production conveyor is equipped with a variable speed coupling on the drive units. The couplings—air-cooled Heenan-Dynamatic controlled slip models—are under group control from the main conveyor control room, one on each floor.

The speed of each conveyor, in any one group, can be individually adjusted by means of potentiometers located on separate panels in the main control rooms, while the entire group remains under the master control of the main control



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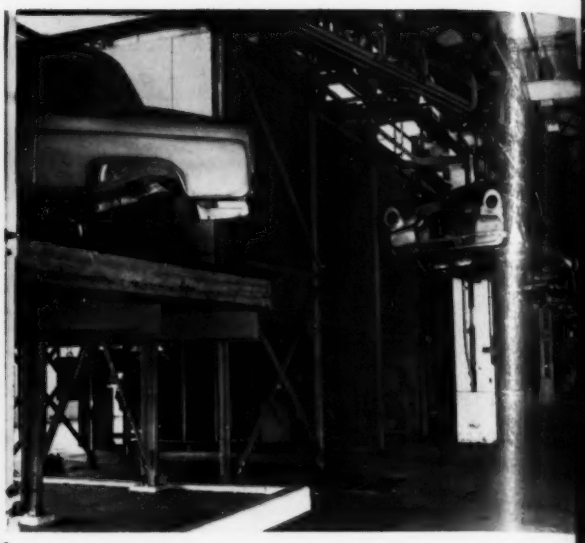

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Fig. 4. Bodies in line storage at the beginning of the process in the paint shop

Fig. 5. Bodies on the stripping line of the phosphate dry-off oven

Fig. 6. Interior of the slipper dip booth—showing the drop in the overhead conveyor

Fig. 7. Body, on its special sling, entering the phosphate system

Fig. 8. Body drop from overhead conveyor to floor conveyor to wet sand deck

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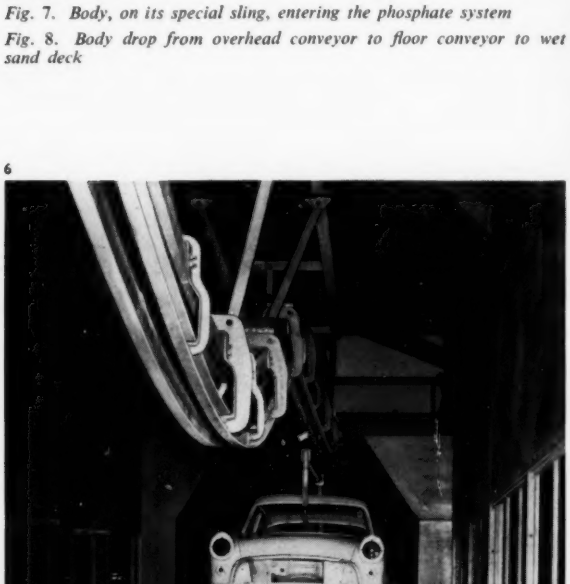

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Fig. 9. Anglia bodies undergoing final rinse on the floor conveyor

Fig. 10. The east end of the paint shop showing cross transfer conveyors and powered lift tables. The table in the foreground is in the raised position preparatory to transferring the Anglia body on to the production conveyor leading into the booth

Fig. 11. At the west end of the painting lines the bodies are passed across at the end of the shop direct to storage on the far side or transferred to the two-tone plants

panel. Electric switches are also provided adjacent to the transfer points should it be desirable to isolate one line.

A special feature of the whole system is the provision of subsidiary conveyor lines at the phosphate machine and at all paint booth ovens to allow the automatic stripping out of the ovens, e.g. at breaks for meals, ends of shifts, etc., Fig. 5. On resumption of work the temporarily stored body shells are automatically, in sequence, fed back into the processing lines. On re-entry to the processing line they are automatically sequenced into pre-set intervals on the production conveyors. Thus body shells are not subject to oven bake, discoloration, etc., during halts in production, and the system also enables the paint plant to be cleaned at selected times.

Floor Conveyors in the Paint Shop

After cooling from the primer bake ovens the body shells are brought over a loading table. Here, two ski-type skids are manually attached to the underside of the shells, the overhead conveyor is turned round the end of the shop and passes the shells to a body 'drop section', preparatory to the next painting processes. These drop sections provide a simple method of transfer between floor and overhead conveyor or vice versa, Fig. 8. Once the shell has been positioned on the floor conveyor, the sling is manually released and returned to the body building plant on the return strand of the main transport conveyor, going through a sling wash system to remove paint overspray before entering the conveyor bridge.

The body shells move forward on the floor conveyor which is of two-strand roller chain design, forming a continuous moving line on which the bodies rest on their skids.

All models go through the following processes on these floor conveyors: 1. spot glaze and ding; 2. dust and water sealing, lower parts; 3. pre-rinse; 4. primer wet sand; 5. Deminrolit rinse; 6. wet sand dry off oven; 7. cool; 8. Inspection, possibly spot repair.

These last processes bring the shells to the end of the shop. Before passing on to the next stage, either ground coating and/or final enamelling on the return conveyor lines, the bodies must be repositioned so that they enter the spray booths in road position. This is achieved by two 180 deg. powered turntables included in the last sections of the line and is an entirely automatic operation.

At the end of the line the bodies are automatically passed to the next process-line floor conveyors by powered transfer tables, Fig. 10. The shells travelling forward operate with their skids, at a predetermined position, a limit switch. This switch actuates the transfer table to rise to the level of the line conveyor. When the shell is fully positioned, the table automatically lowers and the shell is transferred, in a lateral position, to line up with the return process-line conveyor. Here, again, is a similar transfer table which lifts the shell and passes it on to the line conveyor. If, for any reason, subsequent operations are held up, the limit switches are automatically negatived and the transfer table immobilized. In all there are seven limit switches to each transfer table involved in this system.

The shells now pass through the final enamelling operations. Although there are variations in these final operations, e.g. two-tone enamelling and repair lines, the method of conveying to the final storage lines is by means of similar floor conveyors and transfer tables. At all times control of selection and the direction of bodies into the various lines is maintained by a control panel situated at the west end of the shop and overlooking the ends of all conveyor lines.

There are four floor conveyor storage lines; two for the larger models, Consul, Zephyr and Zodiac, and two for the smaller models. Above these storage lines are overhead conveyors on which the painted shells are slung for transfer to the trim and assembly shop on the ground floor.

Small Parts Painting

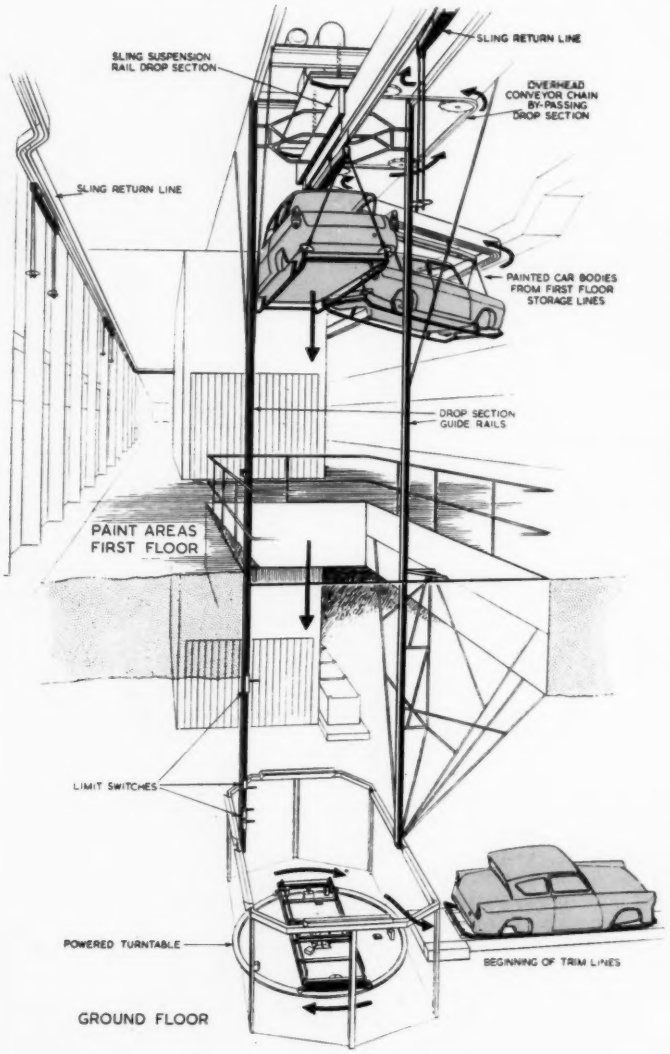
At the east end of the shop all small parts, e.g. headlamp bezels, garnish mouldings, stone guards, etc., are separately treated. They go through a similar set of painting operations and are suspended throughout on 'Power Pulled' overhead conveyors. The system provides a continuous controlled flow through all operations and on completion the parts pass to the trim floor via a lift.

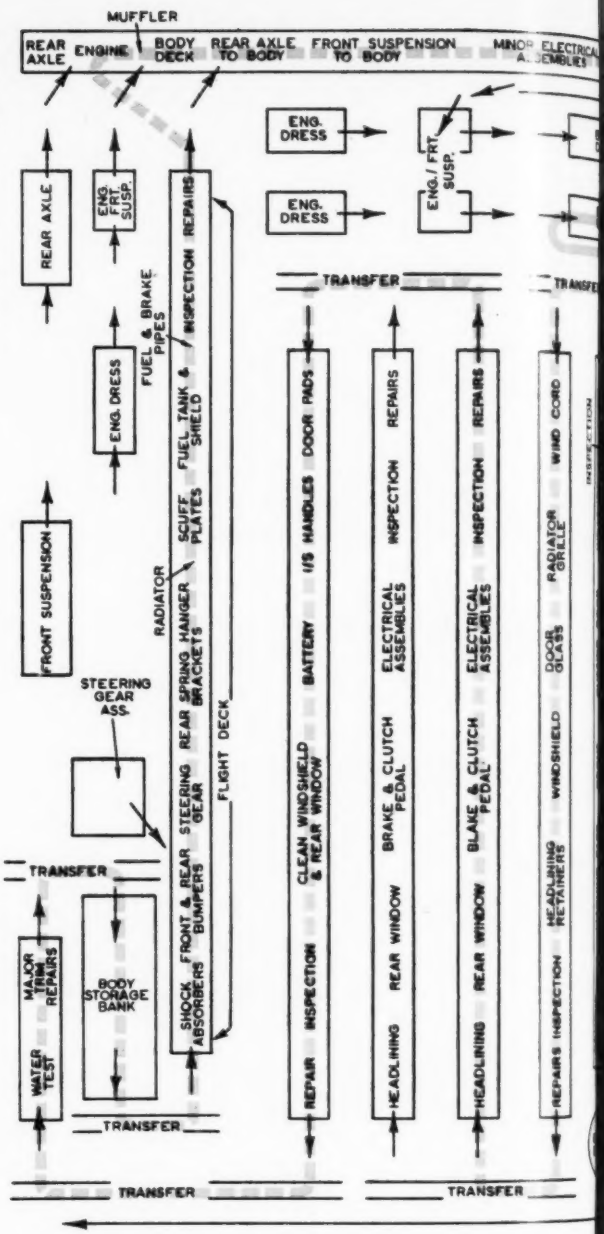
Fig. 12. *General arrangement of trim and final assembly lines—ground floor P.T.A. building*

Movement on the large models' trim lines and final assembly

Movement on one of the small model's trim lines and final assembly

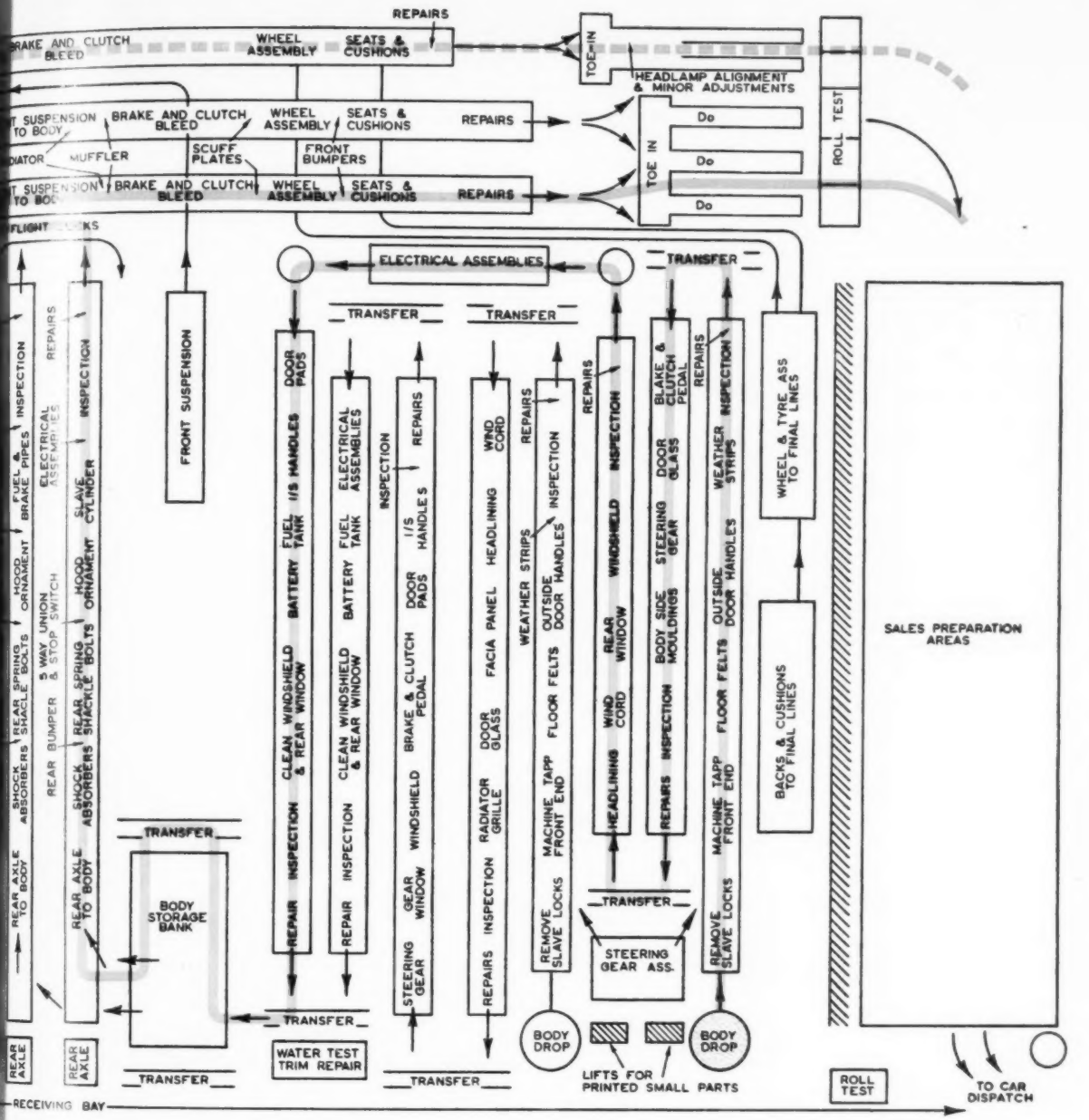
Fig. 13 (*below*). *A simplified sketch of the between-floor transfer system*





Paint Shop Conveyors

Conveyor	No. of Lines	Operational length	Chain length
		feet	*feet*
Overhead Dual Duty.....	27	7,500	16,500
Overhead Power Pulled....	3	4,000	4,000
2-strand chain	30	7,200	28,800
Double 2-strand chain.....	5	950	7,600
Roller flight.....	21	4,500	18,000
Powered rolls	3	90	–
Gravity rolls.....	3	80	–
2-strand chain transfer.....	14	520	2,080
	106	24,840 (4¾ miles)	76,080 (15 miles)



Ancillary Equipment

2	power-operated turntables
45	powered rise and fall transfer tables
10	fixed-height transfer tables
8	body-drops in Dual Duty conveyor

Number of bodies in various stages of completion in paint shop—approximately 820.

Trim and Assembly Floor Workflow

The transfer of body shells from the paint floor to the trim and assembly floor is made through three body drop points as indicated on the diagram, Fig. 12. Reading from left to right on the diagram, the first between-floors body drop transfers the Consul, Zephyr and Zodiac models from their storage lines. The other two body drops are used for the remaining car models.

From the paint floor conveyor storage lines the body shells are slung on to overhead conveyors and carried to their respective body drop area. Here the sling and car body is transferred on to a drop section of the sling suspension rail positioned over the floor hole. The overhead conveyor chain by-passes this section and returns to line up with the other end of the drop section. The transfer of the sling and body to this drop section is entirely automatic. The independent sling suspension rail carrying the car body shell drops to a power-operated turntable on the ground floor.

The body is manually released and the sling attached to the body suspension is returned to the paint floor by remote push-button control. On reaching a predetermined point of its upward movement, the unloaded drop section and sling operate a limit switch, this rotates the power-operated turntable on the ground floor and brings the car body into line with the first of the trim conveyor lines. The movement

Fig. 14. *The drop section transferring a body into the trim and assembly shop below*

of the body on to this conveyor actuates another limit switch which returns the turntable to its receiving position for the next between floor transfer operation.

On the return of the suspension rail to the first floor, a motor comes into operation and passes the sling to the end of the drop section where it is picked up by the overhead conveyor chain and returned to the paint floor storage lines.

The drawing, Fig. 13, is a simplified sketch of this between floor transfer system. Fig. 14 is a photograph of the drop operation taken from the paint floor.

As will be noted from the diagram at Fig. 12 the flow of work on the ground floor falls into a series of parallel lines running south to north and vice versa, with the final assembly lines running west to east on the north side of the building and ending in the Sales Preparation area. In effect there are 3 main systems, the start of each system is at the turntable below each body drop. The diagram shows the general arrangement of the ground floor conveyors and the operations performed on each conveyor line.

All trim operations are performed on two-strand chain conveyors with automatic transfer between the lines, by cross-transfer conveyors, turntables and power-operated lift tables. Where this transfer operation has to cross over a main traffic aisle the conveyor is ramped down to floor level and up again to the next conveyor at operational height, Fig. 15. This allows the use of mobile equipment on the traffic aisles to deliver stock to the various trim work stations along the conveyor lines.

At the end of the trim line conveyors the trimmed bodies are banked in the two body storage areas indicated—one for the large model range, the other for the small models.

From these storage points the trimmed bodies are transferred, according to production schedules, to the three 'flight decks' indicated. These are so arranged as to raise the conveyors, and thus the car bodies, to such a height as to facilitate the assembly of such components as rear axles, shock absorbers, rear shackle spring bolts, fuel tanks, etc.; this enables operatives to work more conveniently on the underside of the car bodies, Fig. 16.

At the end of these 'flight decks' the bodies are transferred to the final assembly lines running from west to east at the north end of the building.

Here the bodies have to be dropped on to their respective engines and front suspensions. In order to achieve this the bodies, after inspection at the end of the 'flight deck', have slings attached to them and are raised by an electric hoist off the floor conveyor. The hoist runs on a closed monorail circuit and is automatically held in a waiting station to be called for by the passage of the preceding body on to the final assembly decking point. The closed circuit hoist and pusher travel mechanism is electrically interlocked and ensures that movement of the hoists, of which there are three in use on the circuit, will only take place when preceding stations are vacant. Figs. 17 and 18 show a simplified drawing and photograph of the Consul, Zephyr, Zodiac transfer and decking hoist system.

When the hoist carrying the trimmed body shell reaches the 'decking' area of the final assembly line the pusher travel mechanism is automatically stopped and the rise and fall of the hoist is operated by push-button control from alongside the floor conveyor. The body and hoist can thus be 'inched' manually along the monorail to assist in the marrying up of the car body with the 'mechanicals' and suspension assembly on the floor conveyor. Once the body has been decked on to its engine and suspension the sling is returned to the hoist, at the same time the pusher mechanism is actuated and moves forward to make contact with the hoist, allowing waiting trimmed bodies and empty hoists to move round the circuit.

The electrical collector track system for this particular transfer has had to be specially designed in relation to the R.S.J. layout of the monorail and the incorporation of automatically energized waiting stations at specified positions on the circuit. The tracks consist of seven bar conductors where required and three bars at the unloading and loading positions and have section gaps and ramps for the trolley brushes. The trolleys are all of seven bar construction and arranged for traversing curves and also to transfer at points where spare hoists are located.

The bodies then move along the final assembly lines. The final operation of electrical assembly, brake and clutch bleeding, wheel assembly and the installation of seats and

Fig. 15. *The twin strand conveyors are ramped down in the trim shop where aisles have to be crossed*

cushions takes place on these conveyors which like the 'flight decks' are raised above ground level for most of their length in order to provide access to the underneath of the cars. There are provisions made for the fuelling of the cars (petrol, water and oil) at the end of the assembly line, involving a complex system of piping and metering from the fuel and storage tanks. Much of this pipework is lagged and contains either steam or electric-traced strips for maintaining lubricants at a constant temperature throughout the system. After a last repair section on these final assembly lines, the completed cars undergo 'toe-in' tests, minor adjustments and a 'roll' test. They then leave the assembly floor proper and are driven into the Sales Preparation floor.

In this area the cars are prepared for the home or foreign markets and undergo any minor repairs that might be required. The cars travel on slat or drag line conveyors and there are facilities for repairs, paint preparation, paint spray and drying—in all there are seven conveyor lines in the area.

Trim Shop Conveyors

Conveyor	No. of Lines	Operational Length	Chain Length
		feet	*feet*
2-strand chain	16	4,500	18,000
Roller flight	9	850	3,500
2-strand chain transfer	15	750	3,000
Powered rolls	1	20	—
Gravity rolls	7	250	—
Special 2-strand chain for:			
Crossfeed lines	3	1,000	4,500
Final lines	3	1,700	7,500
Sub-assembly lines	19	1,100	4,500
Garage and escalator	12	3,500	15,000
Overhead power pulled	7	7,500	7,000
	92	21,170 (4 miles)	64,500 (12 miles)

Ancillary Equipment

5 turntables; 46 powered rise and fall tables; 1,600 ft of hoist rail. Number of bodies in trim shop in various stages of completion—approximately 700.

Ancillary Conveyors

Within the trim and assembly floor proper there are facilities for sub-assembly operations and subsequent feed into the main production lines by a number of ancillary conveyor systems. The illustrations at Figs. 21 and 22 show the beginning and end of the system handling wheel assemblies. Reference to the diagram at Fig. 12 will show where these operations are situated in relation to the general layout. The rims and tyres are withdrawn from palletized and racked stock in the sub-assembly area and placed together on a gravity roller conveyor. From this point the subsequent operations and handling are entirely automatic with regard to tubeless wheel assemblies—there is only a very small proportion of conventional tubed tyres to be manually handled and inflated. The cover is automatically rolled on to the rim, see diagram Fig. 21 (1), automatically inflated through the rim (2), and then picked up by the two-prong fork carrier of the overhead chain conveyor (3). At the final assembly line the delivery of the wheel assemblies is automatically synchronized with the arrival of the designated car and by a system of gravity roller conveyor runs and

Fig. 16. General view of one of the 'flight decks' where the transport conveyor is raised to allow access to the underbodies of the cars

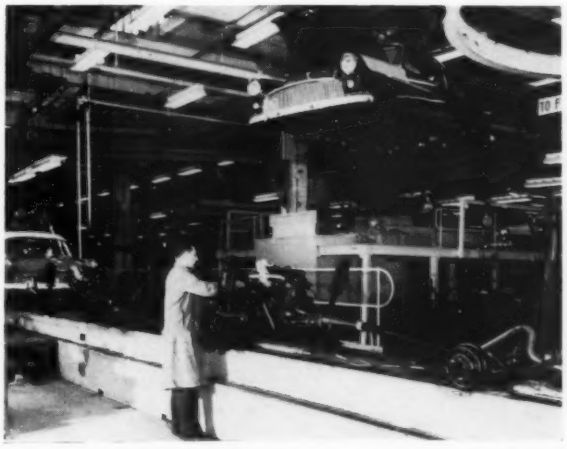
ramps, Fig. 22 (4), the 5 wheels for each car are split to deliver on either side of the car. At this point there is a pneumatic elevator which raises the wheel from the horizontal position to the vertical (5) in order to facilitate positioning of wheels on to the drums and reduce operator movement and fatigue to the minimum.

Each overhead conveyor at its maximum speed will deliver 225 wheels/hr and in all cases the final delivery of wheels is controlled by the operator.

The above description applies to the small model final assembly lines—the arrangement on the Consul, Zephyr, Zodiac lines differs only in that, for reasons of space, only one chute from the overhead conveyor delivers wheels to one side of the car. A gravity roller track beneath the assembly conveyor passes through the alternate wheels to the other side.

Other sub-assembly conveyors are used for the mechanical units, engine, gearbox, etc., upholstery units, backs, cushions, etc., and front suspension, etc., and are all geared to marry up the components carried by them with the car bodies on the main assembly conveyors.

Fig. 17. General view of the decking area of the final assembly line. The large models' 'flight deck' is seen on the right of the photograph. The closed hoist system of transfer is seen at the top



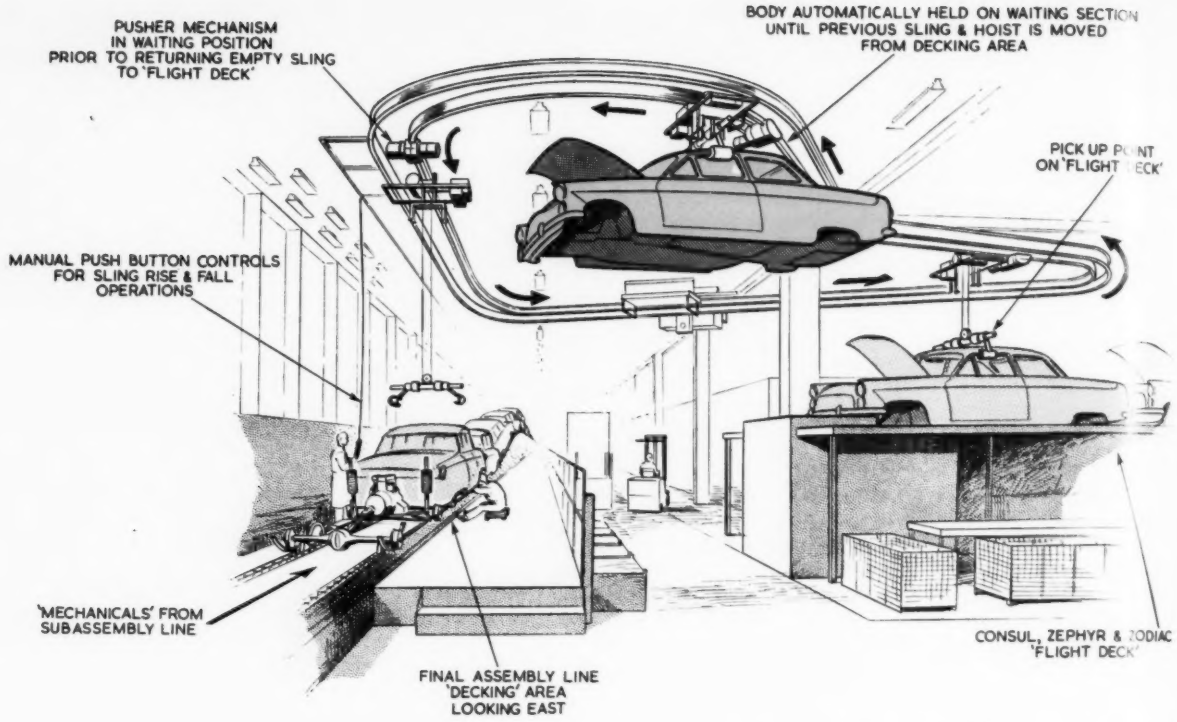


Fig. 18. Sketch of body transfer and decking closed circuit hoist system

Control Features

As stated before, the conveyor systems are under the overall control of two main control rooms—one on each floor. In these rooms a system of light indicators show up any conveyor stoppage or the failure of any transfer table. All production conveyors are electrically interlocked and equipped with variable speed control, thus the controller may vary the speed of all conveyors simultaneously in accordance with production requirements. In addition, there are local control panels in particular areas for the selection and transfer of bodies between alternative conveyors.

By this system some 1,500 bodies in various stages of painting, trim or assembly can be guided and synchronized in their processing throughout the building.

Assembly Components Handling

The foregoing has described the method of handling the car-body shells from the Body Group building through to the Sales Preparation area. On the Trim and Assembly floor the number of components to be handled and stored. in relation to the trim lines, run into thousands and the system of receiving, handling and temporary storage has been as carefully thought out, planned and installed as the major conveyor installations. The following is a general description of the methods and equipment involved.

Fig. 19. One of the powered turntables for returning car bodies down the trim lines

Fig. 20. New Ford Anglias nearing the end of one of the assembly lines, with the flexible exhaust coupling system overhead

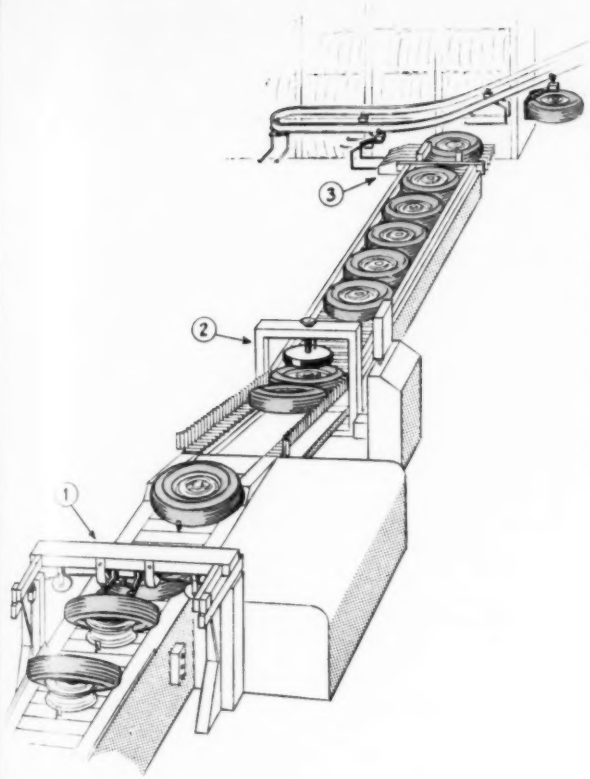


Fig. 21. Sketch of tyre and rim assembly and inflation operations—all tyres and rims are processed in sets (one set to each car)

KEY TO FIG. 21.
1. Automatic tyre and rim "roll-on"
2. Automatic inflation through rim to predetermined pressure (tubeless tyres only)
3. Overhead conveyor pick-up point

Some 440 vehicles deliver to the site in any 24 hours, two thirds in the day shift and one third at night. Outside the building there is a lorry park in which vehicles are held until they are required for unloading. At the gate house the driver hands in his delivery documents to the gate-keeper before entering the park. These documents are transferred by pneumatic tube to a central control point on the Trim and Assembly floor goods receiving area. In this office the type of goods, etc., are noted and the clerk can check on an indicator board which receiving bay is available closest to the point of ultimate usage of the newly arrived material. The gate-house keeper is informed and he, by means of a loud hailer, calls in the lorry from the park.

The unloading area of the Trim and Final Assembly Shop runs the whole length of the building on the southern side and is 75 ft wide by 765 ft long which includes an 18 ft 6 in wide internal roadway. The entrance and exit is through sets of doors at the west and east ends of the building, which form air seals to prevent heat losses.

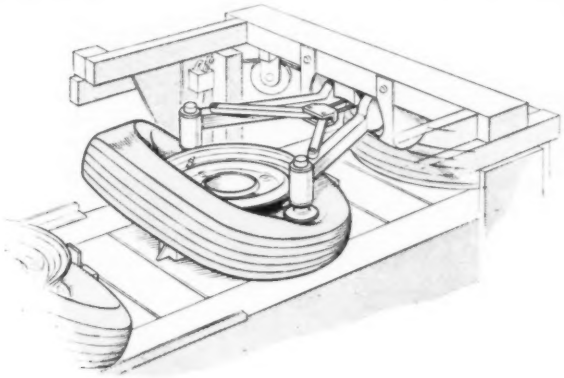


Fig. 23. Detail of mechanism for the automatic 'roll on' of tyres to rims

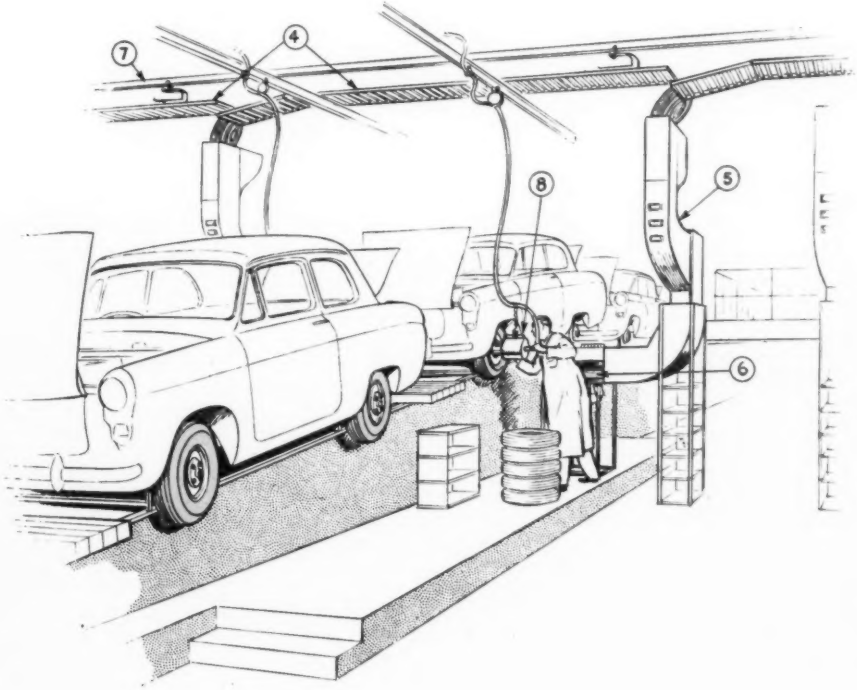


Fig. 22. Sketch of the delivery points for wheel assemblies of the Popular, Anglia and the Prefect models

KEY TO FIG. 22.
4. Overhead system of gravity roller conveyor ramps and drop sections for sequencing wheels to match up with car bodies
5. Chutes for delivering wheel assembly sets from overhead conveyors to assembly points
6. Stand incorporating pneumatic elevator to raise wheel to vertical position prior to assembly to break drum
7. Return line of "fork" pick-ups after dropping wheels on to roller conveyor
8. Suspended automatic nut-runner for assembly of wheel to brake drums

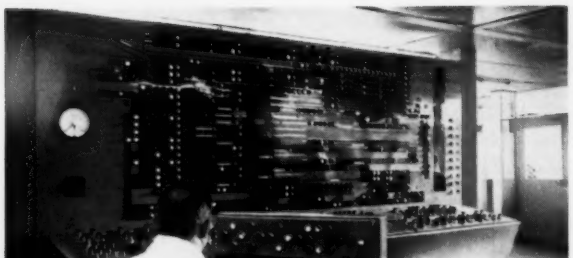


Fig. 24. One of the two main control rooms in the paint, trim and assembly plant. From this point on the first floor the flow of bodies through the entire paint system is tracked and controlled. A similar room on the ground floor controls all conveyors and transfer equipment in the assembly system. Supplementary control panels are sited around the plant where required, e.g., for the diversion of bodies on to repair conveyors

Fig. 25 (right). Local control panels for the conveyor variable speed coupling. The automatic inflation of wheel assemblies and a gravity feed rack for wheel rims can be seen in the background

This area incorporates 17 bays for receiving and shipping facilities, thereby allowing at least 17 vehicles to be attended to at any one time.

Fords have, over the past three years, been consistently encouraging the delivery of all materials in pallet loads and have achieved a large measure of support from their suppliers —some 60 per cent of deliveries are now made in pallets. This has enabled the large scale use of fork lift trucks for unloading purposes and the arrangement of concentrated storage areas.

Adjacent to the vehicle unloading points there is a 15 ft wide aisle running parallel to the vehicle-entry road. This provides ample room for the manœuvring of the fork lift trucks and the tugs and trailers used to distribute material to the trim line storage areas.

The fork lift trucks unload the lorries directly on to waiting trailers. The policy is to keep the area free of all static storage, and supervision is to be recommended for the measure of success that has evidently been achieved in keeping the area clear. It should also be noted that Fords have dispensed with any kind of conventional stepped-loading dock, thus ensuring that the maximum flexibility in area utilization can be attained. Electric tugs then link up with the loaded trailers and tow these to the storage points. The layout of the conveyors, arrangement of the trim and assembly operations, and provision of aisles and storage areas, have been carefully planned to allow 4–5 days' supply of components to be held at each work station. Here the pallets are stacked three high in two rows. The operator takes his material from the bottom and second tier—the top tier is a buffer stock and is moved down by fork truck when required. Within the trim line there are fork trucks, one to every two aisles, for stock movement purposes.

The tugs collect empty pallets and trailers from the storage areas and return them for loading at the receiving area. The combination of fork trucks for lifting, stacking and unloading operations and tugs and trailers for hauling purposes has proved most effective—neither fork trucks or tugs have to wait on the availability of each other at particular times or in specified areas.

Very bulky stores are held in separate defined areas where maximum use is made of stacking heights in block storage. There is an Alpha-numerical stock location system on aisles and stanchions for the rapid storage, retrieval and identification of stock.

Fig. 26. A Coventry Climax fork lift truck unloading a Ford trailer in the receipt area

The overall picture of the ground floor layout emphasizes the degree to which materials handling considerations have affected the conveyor and operational layout. The distance of travel between unloading and storage points has been reduced to a minimum. Gangways 12 ft wide between the trim lines allows the free passage of all mobile equipment and further allows fork trucks and tugs to pass one another in the same aisle. The receiving bay running the length of the building enables 17 vehicles to be in the unloading position at any one time and these unloading positions are in direct line relationship with the ultimate storage points on the trim lines. Where gangways have to cross the transfer conveyors at the end of the trim lines the chain conveyor is ramped down to floor level in order that vehicles may have free access to all areas of the shop floor over the shortest distances.

Some idea of the scale of operations incurred in handling and storing of these components is given by the following table of personnel and equipment involved in this work.

Personnel: Drivers, Storesmen, Clerks, Stock Chasers	388
Hand Pallet Trucks	24
Trailers	350
Electric Platform Trucks	6
Personnel carrier Trucks	3
Fork Trucks, capacity 4,500 lb	37
Reach Trucks	5
Electric Pallet Trucks	6
Electric Tugs	10
Standard Pallets	10,000
Special Pallets	6,000

And the above are only the major items. There are further vehicles, e.g., flame proof trucks for use in the paint area, special purpose tote bins, fibre trays, racks, etc.

An example of the care and attention that has governed the selection of materials-handling equipment is seen in the specification of the fork trucks now in use unloading incoming vehicles in the goods receipt area of the P.T.A. building.

Ford's materials-handling engineers were not satisfied with any of the standard fork trucks on the market. Basically their requirements demanded the advantages inherent in both diesel and electrically operated trucks. After exhaustive tests and consultation with a wide range of manufacturers, a Coventry Climax 4,500-lb capacity, electric fork truck was chosen. This was a new model of the suppliers in which they incorporated operating and design features in line with the specifications desired by Ford's engineers. For example, a considerable reduction in weight has been achieved, thus reducing the demand on the batteries and giving increased power and speed for operating functions. The speed of lift has been increased from the standard of 30 fpm to 35 fpm. The truck, Fig. 26, has a silhouette of low compact design with an 8 ft, extending to 12 ft, mast. Improved operator vision and the decrease in weight allows for increased accuracy in steering and precision positioning of the truck and its forks in unloading and stacking operations. The trucks are capable of working a continuous 10½-hr shift for each charge of the batteries. At the moment 37 of these trucks are working at Fords and it is intended to add a further six trucks to the fleet.

Control Features

The control of routing of incoming material is the responsibility of the Internal Transport Foreman. He uses an electric personnel truck equipped with two-way radio communicating with the Central Goods receiving office. By this means he can swiftly cover the whole shop, moving vital material and stock chasing. In addition there are Line feed foremen and stock chasers, responsible to the Production Superintendents of each model, for particular sections of the production floor. Zone fork lift drivers, day and night shift, have specific responsibility for maintaining adequate stocks within these areas.

Fig. 27. An Omic tug hauling a trailer train to the trim work areas

Fig. 28. General view of one of the trim lines showing the line storage of palletized components

Fords have also devised an early and late warning system for critical points on the floor, e.g., storage banks, tyre and rim assembly, seat assembly and engine dressing. Should the sequence of a model be upset in any way, e.g., minor repairs, repaint, etc., a teleprinted message is sent to these points. Thus adjustments can be made to the schedule of seats, wheels and sub-assemblies and the assembly line kept in continuous production.

Among the many firms engaged in the constructing and equipping of the Ford Motor Company's new Paint, Trim and Assembly (P.T.A.) building, and which will be of interest to our readers are the following:

Architect: Martin Hutchinson, L.R.I.B.A.; **General Contractor:** G. Percy Trentham, Ltd.; **Car Engine Exhaust Ducting System:** Andrew Air Conditioning, Ltd.; **Car Painting Equipment:** The Aerograph-Devilbiss Co., Ltd.; **Water Plant:** The Permutit Company, Ltd.; **Fork Trucks:** Coventry Climax, Ltd.; **Spray Booths & Dip Tanks:** John Lysaght's Bristol Works, Ltd.; **Stacker Truck:** I.T.D., Ltd.; **Trailers:** Diac, Ltd.; **Fork Truck/Series 51:** The Yale & Towne Manufacturing Co.; **Pallet Trucks:** The Yale & Towne Manufacturing Co.; **Platform Trucks:** Brush Coachwork, Ltd.; **Personnel Carriers:** Wessex Industries (Poole), Ltd.; **Tugs (Electric):** Omic, Ltd.; **Pallets:** Diac, Ltd. (New Addington), Thorpe Bros. (East Molesley), C. R. P. Trade Products (Hayes, Middx.); **Fibre Work Trays:** J. Burns, Ltd., White, Child & Beney, Ltd.; **Flame proof Fork Trucks:** Conveyancer, Ltd.; **Reach Trucks:** Lansing Bagnall, Ltd., Jewsbury's Mechanical Handling, Ltd.; **Pneumatic Tube Conveyors:** Lamson Engineering Co., Ltd.; **Electric Truck Batteries:** Exide; **Special Purpose Containers:** Three Star Co., Ltd.; **Electric Lifts:** Pennie Lifts, Ltd., Evans Lifts, Ltd., Keighley Lifts, Ltd. **Conveyor Controls:** Square D Limited, Heenan & Froud Ltd.; **Conveyor Wiring:** H. M. Scriven, Ltd.; **Conveyors, lift tables and turntables:** Geo. W. King, Ltd., **Electric Hoists and Cranes:** Munck International A. S., Export Division of Svere Munck.; **Barrel Elevator:** Sovex, Ltd.; **Pneumatic Motor Chain Hoists:** Globe Pneumatic Eng. Co., Ltd.; **Body Slings and Skids:** Diac, Ltd.

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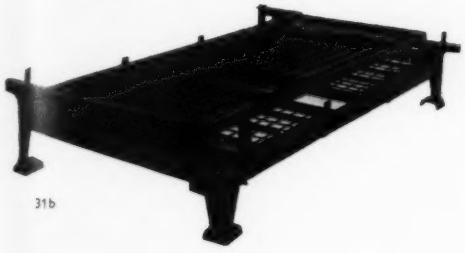

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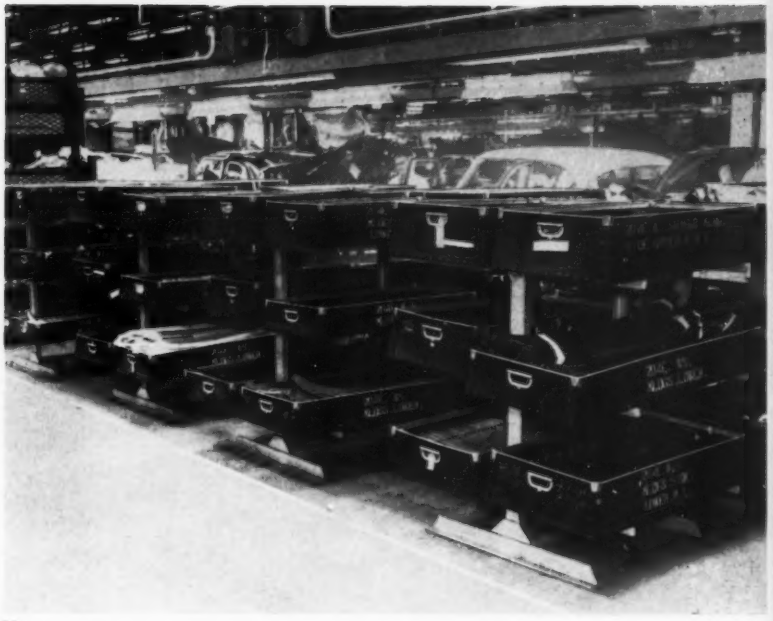

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Fig. 29. *A Lansing Bagnall reach truck working in one of the bulk storage areas*

Fig. 30. *Special 'tree racks' and fibre storage trays for holding painted small parts on the trim lines*

Fig. 31*a and b. Example of one of the many special purpose pallets. This one is used for holding exhaust muffles and is shown in use and in the collapsed state*

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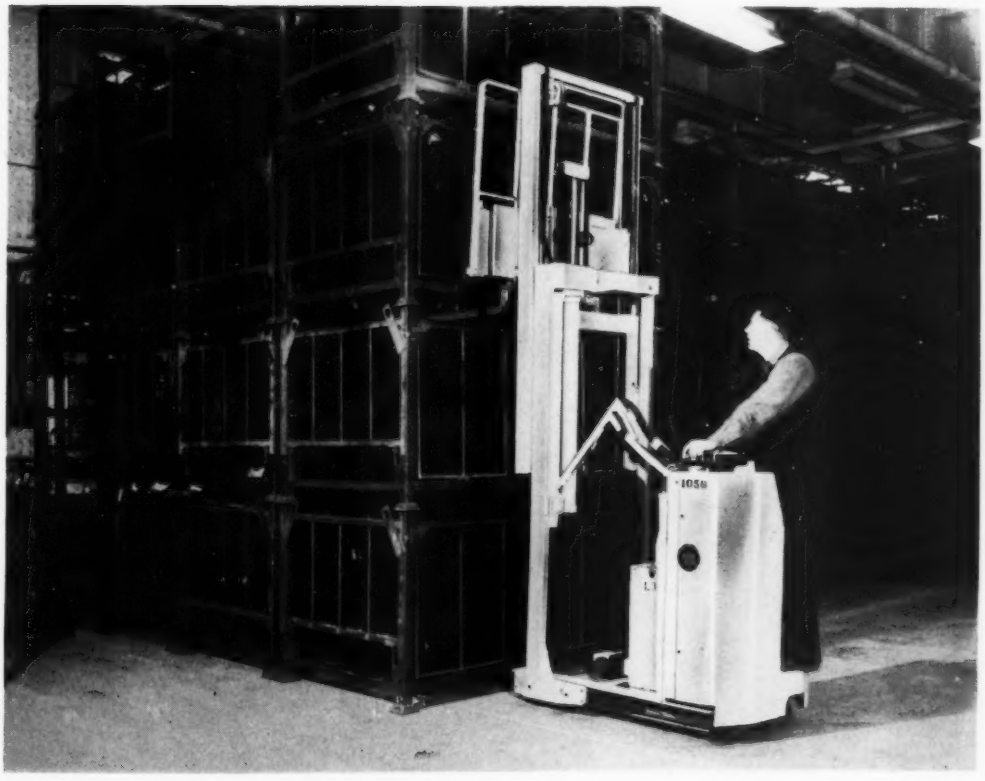


AUTOMATIC PLATING PLANT

SUCCESSFUL commissioning of a new automatic plating machine at their Haydock (Lancs) factory, is announced by Thomas Crompton & Sons, Ltd., one of Britain's leading manufacturers of ironmongery for the aircraft, building, marine, automobile, railway and other industries.

The new automatic plant, which in an eight hour shift plates up to 30,000 parts with nickel or chromium, replaces a hand-operated system.

Nickel plating and chroming for Crompton's hundreds of household and industrial items will henceforward be carried out in this machine while brass plating will continue on a similar smaller machine equipped in 1957 when the factory was opened. Both the new plating plant and the previous machine have been supplied and installed by the Electro-Chemical Engineering Co., Ltd.

Apart from saving in labour, the advantages of automatic working which are confirmed by Crompton's engineers include regularity of output, simpler quality control, more reliable pre-cleaning, and reduced losses of chemicals owing to drag-out spilling.

Installation of this plant is a further stage in automating ironmongery manufacture, which has been carried out in Lancashire by Thomas Crompton & Sons, Ltd. for nearly two centuries. Their main market is Britain but there is an appreciable export business notably in Canada, New Zealand, South Africa and the West Indies.

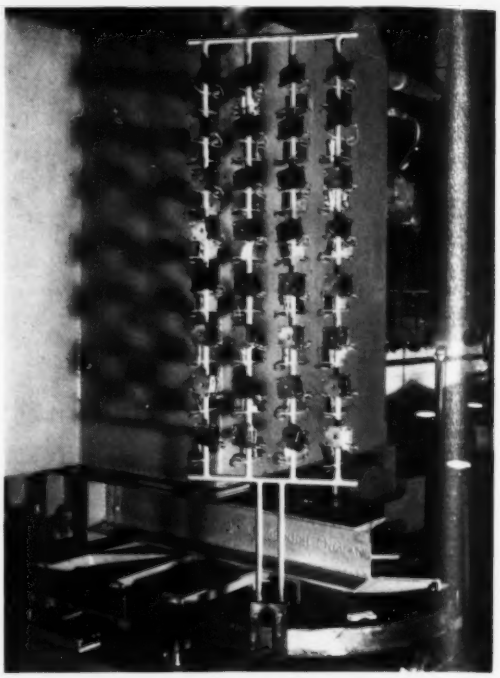


Fig. 2. The final drying process for ironmongery, following plating in the new automatic machine

The new machine is manually loaded at present, but provision is made for automatic loading in the near future. Parts are located on spring racks measuring approximately 30 × 12 in. The machine is constructed in three main sections, carried on rolled steel supports, which provide an air space below. Heating is effected by coils and a heat exchanger using steam at 40 p.s.i.

Main processes are cleaning, pre-treatment, bright nickel and chromium. Approx. 0.0005 in bright nickel finish is deposited in 11½ mins at 60 amps/sq. ft. or a similar coating of chromium in 5½ mins at 120 amps/sq. ft.

Transfer of plating racks is carried out by hydraulic cylinders fed by a separate floor-mounted oilpump and pressure assembly which is motor driven; a hydraulic drive control panel is embodied. Rectifiers and transformers are alongside, together with a final drying station.

Overall length of the complete installation is some 37 ft and the width 13 ft.

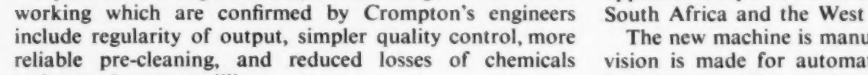


Fig. 1. The new automatic plating machine installed at the Haydock works of Thos. Crompton & Sons, Ltd. for plating up to 30,000 ironmongery parts per eight hour shift with bright nickel or chromium

HANDLING WITH INDUSTRIAL TRUCKS

PART 6—SAFETY AND INDUSTRIAL TRUCKS

by L. J. Hoefkens, A.I.Prod.E.

SAFETY in connection with the operation of industrial trucks and particularly power-driven trucks in our warehouses, docks, and manufacturing establishments, cannot be emphasized too strongly or too often. By safe operation is not only meant the personal safety of the truck driver as frequently he is not subject to many serious hazards. On the contrary he is often in a relatively safe working position. It involves in the main the safety of pedestrians and other factory personnel, and the prevention of damage to plant, factory fittings and fixtures and material handling equipment, including the trucks themselves. It is claimed, and rightly so, that the employment of industrial trucks is to increase efficiency, and one of the factors is by means of a reduction in industrial accidents and strains due to manual materials handling. This being so, it is pointless making these improvements for one section of the personnel if the means to achieve it are permitted to nullify these benefits by increasing the accident rate to others and by multiplying the damage to equipment. While established and reputable truck manufacturers construct trucks with all possible engineering skill and incorporate safety features and overload factors in the design of their products, nevertheless in the ultimate their safe operation depends largely on the human element—the driver. Unless he has been carefully selected with a view to the special requirements of the job, adequately trained in the use of the equipment, and is competently supervised it is possible that the envisaged economies which justified the acquisition of the equipment will not be realized and that it could become a source of continual worry and expense.

On our roads and highways, traffic is canalized into very definite lanes and is controlled by a stringent set of rules —our Highway Code. Assistance to the flow of traffic and to the avoidance of accidents is afforded by traffic police, signs, traffic signals, white lines and pedestrian crossings. The enforcement of these rules and regulations is the severity of the law of the land and financial penalties such as fines and increased insurance premiums. In spite of all this the ever-increasing number of fatal and serious accidents continues to appal the nation. Contrast these conditions with traffic in our factories. Few if any traffic lanes, trucks have to go to any part of the factory, in and out of buildings, dodge in between machine tools, turn blind corners, and pass by office doors with more often than not no signals at all. Pedestrians are free to wander at will in any direction and not always are the recognized traffic aisles kept clear. Industrial truck drivers have even to watch out for overhead obstructions and for hazards which a few minutes previously did not exist. In spite of this apparent 'do as you like' and 'go where you like' chaos, few accidents happen as a result of industrial trucks. Why then this strange contrast? Is it perhaps that factory personnel unconsciously realize that great care is needed because of this absence of regimentation? Or is it perhaps that those employed in a factory work more as a team or social unit with a greater regard for one another than when they are outside its precincts either as a pedestrian or a motorist? It is a problem, and the answer is not obvious.

The selection and training of industrial truck drivers is fully discussed in another chapter so it is only necessary here to stress once again its importance.

The Industrial Truck Manufacturers Association which, as its name implies, is an association of the leading industrial truck makers in this country published a booklet entitled 'Safety Code for Industrial Power Trucks' in the interest of better materials handling. They were aware that owing to the widening use of power trucks in industry that agreement was necessary to lay down a recommended Code of Practice in connection with the safe design and use of basic equipment. They considered that the wide variety of machines now available to users offers more scope for maltreatment that probably any other category of industrial equipment. The manufacturers, members of the association, have bound themselves to provide the highest possible factors of safety compatible with modern engineering practice. This development is most reassuring for truck users who can now rely upon the fact that any equipment purchased from member firms of the Industrial Truck Manufacturers Association will incorporate all reasonable safeguards. Nevertheless it is emphasized that much rests upon the driver, his care and intelligence. It is earnestly suggested that every truck user should obtain a copy of this booklet and should acquaint his operating personnel with its contents.

Tests for Stability

An important point in regard to safety of the cantilever rider-controlled type of fork lift truck has come to the fore; namely its stability. Certain American truck users made increasing demands in their specification requirements which prompted some engineers to undertake a considerable amount of research into the problems involved. Following on a paper published by them a committee was set up to study this matter thoroughly and to devise tests. After a considerable period of investigation a report was published giving their findings, and now similar studies are being undertaken by manufacturers in this country. It was realized that up till then only consideration had been given to longitudinal stability, that is the possibility of the truck tipping forward or backward. Lateral stability or tipping sideways had so far received little, if any, attention although it was found that more accidents had occurred due to lack of lateral stability than lack of longitudinal stability. Ingenious tests were devised during which a truck carrying a load in various positions performed a number of evolutions at top speed, for instance, turning an 'S' bend at high speed, running over a baulk of timber with one wheel

immediately on a right angle bend, etc. Outriggers with auxiliary wheels were fitted to the trucks to prevent them turning completely over and causing injury to the driver and damage to the truck. Such tests were filmed and thoroughly studied and analyzed and it was realized that there were many complicated and varying conditions present in this method of dynamic testing making mathematical prediction of behaviour exceedingly difficult. Consequently a series of static tests have been devised, for which purpose an adjustable tilting platform is used to which the truck to be tested is secured. Such conditions of testing are constant and safe and can be so designed that within certain limits they will prove a truck to be safe when in use. The tilting platform simulates the effect on the stability of the truck of the centrifugal forces when a truck is turned in circles of varying diameters at high speed. This is the lateral stability test. It also simulates the effect of the horizontal forces on the longitudinal stability of the truck when it strikes an object in its path or due to sudden braking, acceleration or deceleration.

These tests also make allowances for deflection of the mast and wheels and such like variables. At the moment the tests only apply to cantilever type trucks having a seated driver and with a lifting capacity not exceeding 10,000 lb. It has been agreed that these tests will extend over a period of two years when no doubt the accumulated experiences of truck makers will be pooled and published. Furthermore, it is to be hoped that eventually tests will be devised and research undertaken into the stability of other types of trucks.

Training for Drivers of industrial Power-propelled Trucks

There is not always a full realization by some managements of the need for a specialized training and the acquisition of driving skill before an operator is permitted to take an industrial power-propelled truck into full use and to drive it inside a factory among pedestrians and valuable plant and machinery. Especially when the more complicated trucks are concerned such as a fork lift truck it is frequently looked upon as 'just another truck' and any labourer is assigned to the job, or perhaps a man who previously has been driving a small electric or petrol truck around the works is deemed fit to take over this new duty without more ado.

The fork lift truck being perhaps the most complicated truck in universal use, the training required for its driver will be described at length and in detail. Based on this, training programmes can be worked out for other types of trucks.

A fork lift truck is a powerful and heavy machine, but in addition to its vehicle characteristics it has its main function, namely, that of stacking or unstacking containers or pallets or sometimes even unpalletized goods which requires a special skill and knowledge and, therefore, a special training. Without proper or adequate training, the truck becomes a grave source of danger to human life, considerable damage can be caused to equipment and factory fixtures, much time can be wasted and the truck itself will not render the valuable services of which it is capable.

It is universally recognized that training must be given to a machine operator in order that a good product is made in the proper time and so that the operator does not incur personal injury, but with the fork lift truck we have a powerful mobile machine which has been acquired to perform a definite function in a works, and will be moving around in machine shops and stores, so that personal injury to the operator hardly arises, but the more serious aspect of injury to other persons and damage to equipment, plant and factory fixtures is a matter so important that careful consideration must be given to it by managements.

A planning engineer or a material handling engineer who has perhaps had considerable difficulty to prove the need or the economics of his case to purchase fork lift trucks should take every precaution to ensure that he does not earn himself a bad reputation amongst his colleagues or superiors for having introduced a cause of personal injuries and accidents and an additional overhead expense for the constant repair of factory and stores equipment and fixtures damaged by his unskilled and untrained fork lift truck drivers.

It is, therefore, very obvious that training must be given. Training in driving, training in stacking operations and other fork lift truck functions, training in the routines to be followed, and training in general behaviour, safety rules and regulations. In other words he must be taught to understand and to appreciate the Highway Code applicable to a works or warehouse. Finally, this training must be given to the right type of person who should have the following qualifications and for the following reasons.

Qualifications

Firstly, the operator selected for training should be mentally alert, have a neat and tidy appearance, possess a good average intelligence and be in good health. Good health will, as a rule, go together with mental alertness which is essential on a job of this nature. These trucks usually work long hours and often in busy or congested areas, and consequently the driver cannot relax for one moment while his truck is in motion. He must continuously check all

Fig. 1. Placing a single pallet load

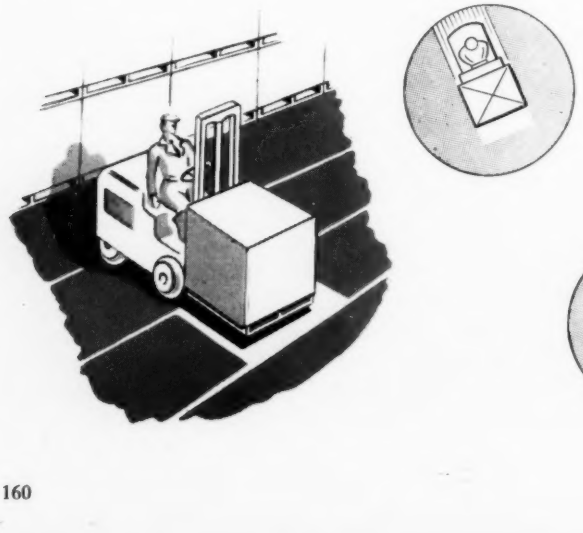
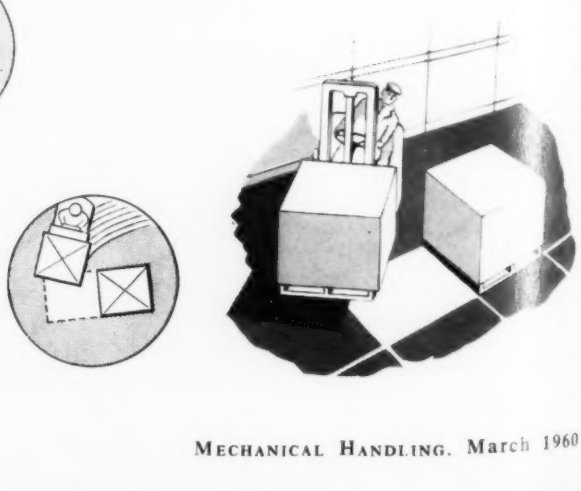


Fig. 2. Placing pallet loads adjacent to one another



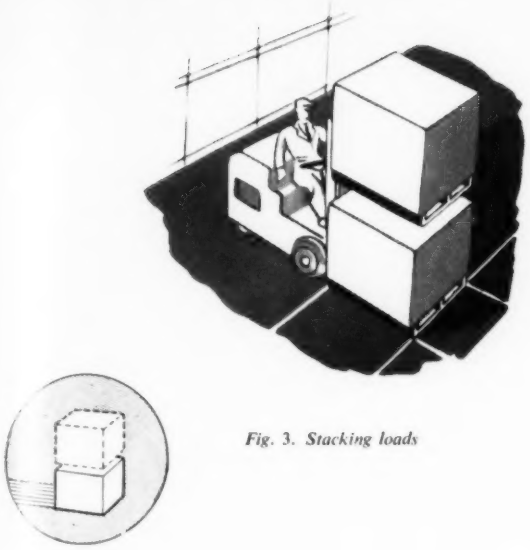


Fig. 3. Stacking loads

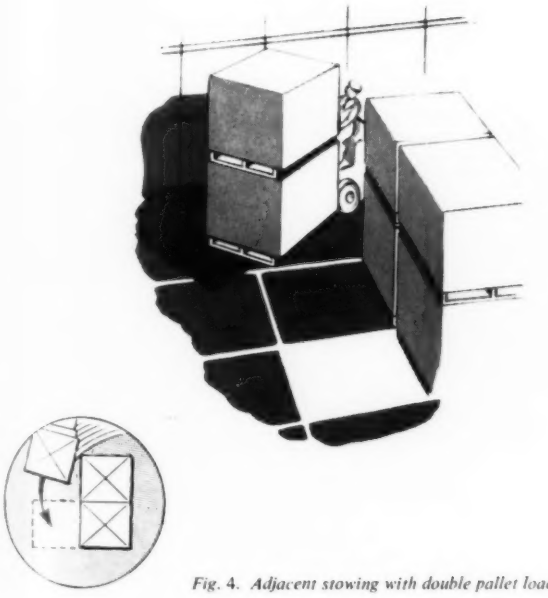


Fig. 4. Adjacent stowing with double pallet load

The prospective driver having been selected should now be placed in the care of the person who will be responsible for the training. This could either be the supervisor in charge of truck and vehicle maintenance who will, of course, have all the required knowledge, but better still would be the driver's future supervisor if this is practicable. It will depend on the type of organization which individual will undertake the training, but the best person is the man's own supervisor from whom he will take his instructions as a fork truck driver later on. It is helpful, but not essential, for the trainee to have had previous driving experience preferably of a heavy vehicle. In either case preliminary instructions will have to be given regarding the fork lift truck and its general operating principles. The driver will then be introduced to his truck and be taught the basic principles of driving and will be shown by demonstration how this should be done. He should then be allowed to handle and drive the truck in an open area under constant supervision and correction of any errors, which at this stage could be habit-forming. An open area is suggested so that no damage can be done or accident incurred of any kind, which in these early stages could undermine the confidence of the driver. Special emphasis must be given and plenty of practice must be carried out in driving in reverse, as this will be done extensively under actual working conditions.

The trainee should pass satisfactorily all the normal driving tests and be able to drive safely in congested areas before any training is given at all in handling loads or stacking work which should constitute the second phase of the training and should be kept quite distinct and separate from the driving of the vehicle itself.

This second and very important part of the training takes the form of eight distinct and separate exercises. The exercises commence with the simplest operation which the driver will be called upon to perform in his daily duties and they progress through all the usual operations associated with a palletized store. The driver should pass a test with satisfaction on each exercise before being given the subsequent one to practise.

It is advisable to lay out the exercise in an open space in a yard where the driver will be free from as much distracting and embarrassing observation as possible so that he can

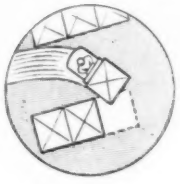
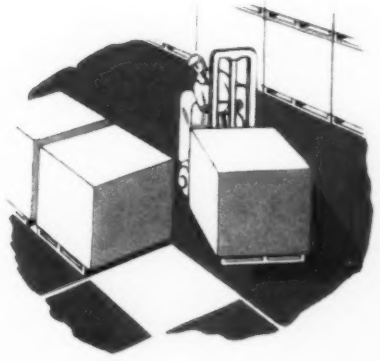


Fig. 5. Positioning from a standard gangway

around him for obstructions in all three dimensions and must always be in a state of anticipation for pedestrains or other traffic coming out of gangways and doorways. This continual alertness which is so essential can be even more strenuous than driving a vehicle on the public highway.

A neat and tidy appearance usually indicates that the individual himself will be orderly in performing his work, a commendable attribute for stores work. A good average intelligence will ensure that the training will be accepted and practised because it has been understood and the reasons will be appreciated. Secondly, good eyesight is necessary as judgment of distances is required for stacking operations. This qualification should be checked periodically.



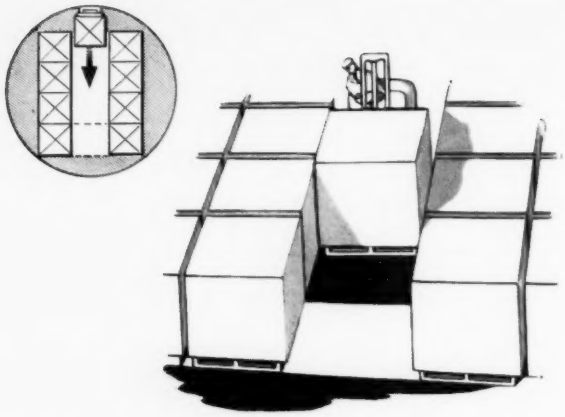
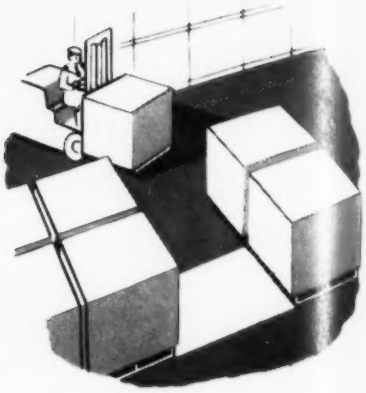


Fig. 6. Placing pallet loads in block-stack pallet formation



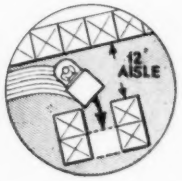


Fig. 7. Placing pallet loads in a block-stack pallet formation from standard gangway

give the maximum concentration to the job in hand. A practice period of, say, two hours per day should suffice.

Exercise 1. *Placing a single pallet load*

As these exercises are designed to develop skill and accuracy it is desirable that imaginary gangways and a 'target' area should be marked out on the ground. The width of the gangway and size of the target area will depend on the type of fork lift truck and size of pallet which will be used, e.g. a 12-ft gangway for a 2-ton truck used with a pallet 36 in deep.

(1) Lift a pallet load centrally on the forks a few inches off the ground, drive around with it and approach the target area, then with one swing deposit the load precisely on the target area.

(2) Repeat this until precise accuracy has been obtained both with a left-hand swing into the target area and a right-hand swing.

Perfection is achieved when this can be performed in one swing without the need to back out and shift sideways, which are great time-wasters in truck operating and produce unnecessary wear.

Exercise 2. *Placing pallet loads adjacent to one another*

(1) Place one pallet load adjacent to the target area.

(2) Place a similar pallet load on the forks and raise a few inches from the ground.

(3) Travel past the stationary load and spot the load on the forks on the target area both with a left-hand swing and a right-hand swing.

(4) Repeat until the load can be positioned accurately, i.e. within 2 in of the stationary load with a single swing in.

Exercise 3. *Stacking*

(1) Place one pallet load on the target area.

(2) Place a similar pallet load on the forks and raise a few inches from the ground.

(3) Approach the stationary load and raise the load at the same time.

(4) With one swing in bring the truck to rest with the load on the forks precisely square over the stationary load.

(5) Bring the mast, which has been tilted backwards whilst the truck was travelling, to the horizontal position.

(6) Lower the forks and stack the load.

(7) Withdraw the forks by lowering them slightly and tilting the mast forward, if necessary.

(8) Reverse the truck and as soon as forks are clear of the pallet drop them to within a few inches of the ground and tilt the mast backwards.

(9) Repeat the movements without load and then unstack.

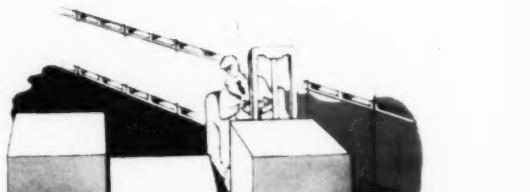


Fig. 8. Forty-five degree stowing

(10) When perfect, repeat exercise with a double pallet load on the forks.

Exercise 4. *Adjacent stowing with double pallet load*

(1) Arrange practice area as shown in the illustration.

(2) Pick up a double pallet load on the forks and raise a few inches from the ground.

(3) Drive alongside the stationary stacks and with one swing turn in past the stacks and spot the load precisely on the target area.

(4) Repeat the same operation but driving in reverse.

This exercise provides experience of conditions of limited vision such as driving from a main gangway into a side aisle with a full load.

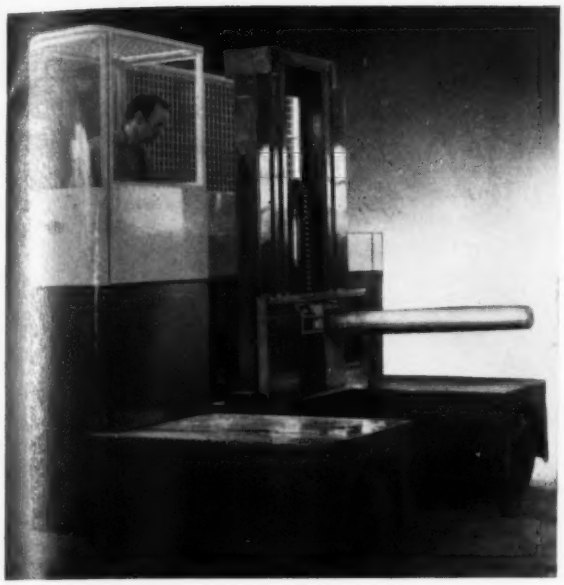


Fig. 10. Cleco 3-ton capacity side-loader fitted with boom attachment for handling reels of wire

Exercise 5. ***Positioning from standard gangway***

(1) Now mark out the standard gangway width which will be used (dependent on size of truck and pallet).

(2) Position several pallet loads as in illustration.

(3) Practise positioning single and double pallet loads precisely on the target area but this time keeping within the laid-down gangway width.

(4) Practise also removing the load by approaching down the gangway with empty truck.

(5) These skills are of major importance and must be accomplished with one swing in without reversing and shifting.

Exercise 6. ***Placing pallet loads in a block-stack pallet formation***

(1) Set out two rows of pallet loads leaving a gap between them equal to one pallet load plus about 6 in.

(2) Pick up a single pallet load on the forks and raise the load several inches from the ground.

(3) Approach the gap and drive down the gap and deposit load precisely on the target area.

(4) Repeat the exercise with left-hand and right-hand swing in and with a double pallet load.

(5) Practise removing the pallet load from the target area by approaching it through the gap with an empty truck and reversing up the gap into the open.

Exercise 7. ***Placing pallet loads in a block-stack pallet formation from a standard gangway.***

(1) Set out the pallet loads as in the illustration.

(2) Mark out a standard gangway.

(3) Practise the movements as in Exercise 6, but keeping strictly within the limits of the gangway.

(4) Repeat until this most important exercise is perfect. It is a very difficult movement as an absolutely perpendicular approach to the gap is required. Under normal working conditions this is one of the manœuvres most frequently carried out.

When perfection has been reached repeat, but finish the movement by stacking the load on a pallet previously positioned on the target area.

Exercise 8. ***Forty-five degree stowing***

(1) Place several pallet loads as shown in the illustration.

(2) Practise positioning a load on the target area at an angle of 45 deg to the gangway.

(3) Place further loads to continue the row.

(4) Continue with double pallet loads.

(5) Practise the removal of loads on the target area.

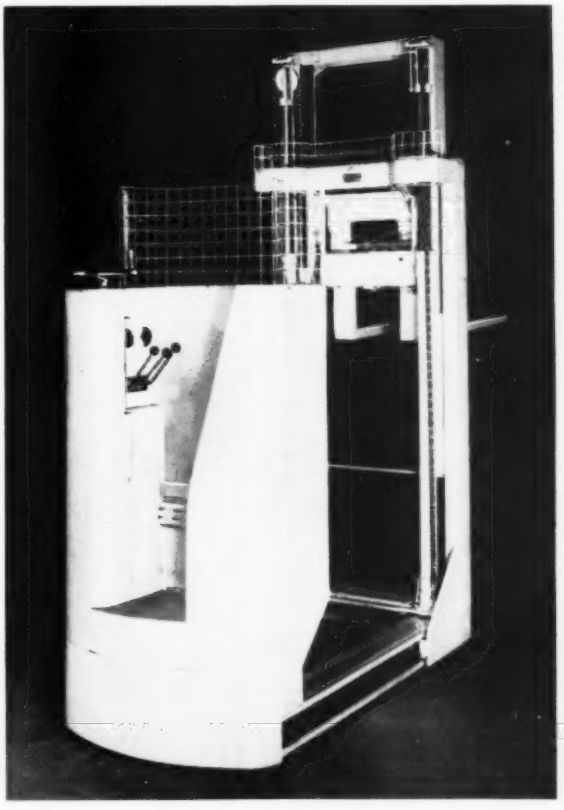
When the prospective driver is proficient in performing these various exercises, which should take somewhere in the region of 10 training hours, he can be considered 'safe' to be permitted to enter the factory or warehouse and to travel around amongst people and to be put to work on stores functions.

Finally, it is good psychology to make the 'passing out' as official and serious as possible in order to impress the driver with his new responsibilities.

In the author's experience a good way to do this is to call the driver into his supervisor's office and there in the presence of the works safety officer to read over to him the works' 'Highway Code' and to explain it to him. He is asked to sign a copy signifying that he understands it and agrees to it. This copy is filed by the supervisor and an additional copy is given to the driver.

A very long list could be compiled of 'do's and don'ts' for fork lift truck drivers, most of which are really commensense little items which will have been impressed on the driver during his training and will come naturally to him if the right type of man has been chosen. To make too long a list would seem to be too terrifying and would not be so impressive as a few main points, particularly any which are really special to one's own factory layout or way or working.

Fig. 9. 3000 lb capacity Cleco reach truck fitted with side shift. Dual drive—no castor



A suitable example is as follows:—

SAFETY FIRST

The trucks which you drive can cause serious injury to your fellow workers if care is not taken by you when driving round the shops and roadways.

Therefore, careful and safe driving is one of your greatest responsibilities.

Always remember the following simple rules:

(1) Keep to the middle of the roadways.
(2) Drive slowly.
(3) Take a corner as widely as possible.
(4) Approach a blind corner or crossing with the utmost care and sound your horn or bell.
(5) Do not move containers or pallets which are broken or over-loaded.
(6) Never stack a broken container.
(7) If you think something is dangerous ask your supervisor's advice before doing it.
(8) Never take risks.

Once again, never forget that the fellow just round the corner cannot see you and that his safety is in your hands.

Signed.....
Fork Lift Truck Driver.

A word of explanation is needed regarding Rules (1) and (3) as these are rather contrary to accepted practice in normal driving. When driving on roads in between factory buildings it has been found that if trucks keep to the side of the road they are very liable to hit into doorways which may be suddenly opened either by other trucks or pedestrains or, during the summer months, when the doors are usually left open during working hours; trucks or pedestrians can emerge suddenly into the road and would thereby render a collision almost unavoidable. By keeping to the centre of the roadway there is much less danger of this occurring and should the driver who is proceeding along the road wish to turn into a factory door he has ample opportunity both to turn and to observe whether his route is free.

To take a corner of a building as widely as possible also helps to avoid pedestrians who are inclined to walk alongside a wall and emerge round a corner without any warning.

Lastly, the driver can be presented with an Internal Transport Licence. This can be made to look as much like an ordinary driving licence as possible. It has three pages, the first of which certifies that A. N. Other, Check No. 1234, having successfully passed his driving test, is hereby authorized to drive the following vehicles *within* the premises of the XYZ Co., Ltd.

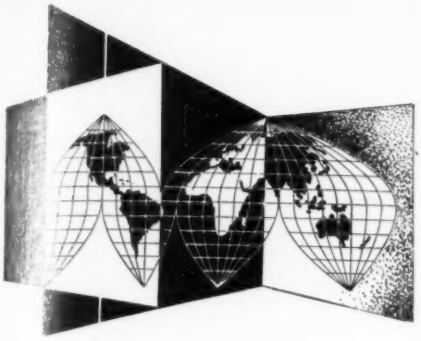
The various types of vehicles are listed: diesel fork-lift truck, electric fork lift truck, etc., and against each one is a space for the signature of the garage foreman for driving proficiency and a space for the supervisor to sign that all the necessary tests have been passed.

On the second page is quoted the date of issue, and the holder signs the following statement:—'I have read and understand the XYZ Safety Regulations'. In heavy type it is stated that this licence must always be carried by the driver when operating a vehicle.

The third page is headed 'Endorsements', and is for the purpose of recording any accidents, damage or breaches of the XYZ Highway Code or Safety Regulations.

It is pointed out to all drivers that severe disciplinary action will be taken by management based on the nature or frequency of any such endorsements.

Fig. 11. *Cleco* 3-*ton capacity side-loader*



BRITISH MECHANICAL HANDLING EQUIPMENT OVERSEAS

British mechanical handling equipment is to be found working in most countries of the world. Each year since the end of the war, sales to overseas customers have increased. Buyers from overseas flock to the Mechanical Handling Exhibitions (organized by this journal) held every two years in London, so great is the regard for British equipment.

In this feature, to be continued each month, we shall bring you brief details and illustrations of such British equipment designed for, or at work in, countries abroad.

Overseas readers requiring information on any type of British mechanical handling equipment, or names of manufacturers' agents or representatives in a particular country, are invited to write to the Editor.

↑ **TRIPOLI.** *This International Drott B-6K-3 Skid Shovel in Tripoli loads 88 to 100 trucks a day with debris*

← **VENEZUELA.** *Ransomes Forklift Trucks at work at the Shell Petroleum Depot at Maracaibo, Venezuela*

UGANDA. *One of the driers with feed and collection bins, there are 73 such bins in the plant at the Bugisu Coffee Board plant. Flow is controlled automatically by Tidal units from bulk bins with a capacity of about 350 tons, the plant can be run by unskilled labour and contains both Redler Conveyors, Ltd., machines, and Conveyors (Ready Built), Ltd., equipment*

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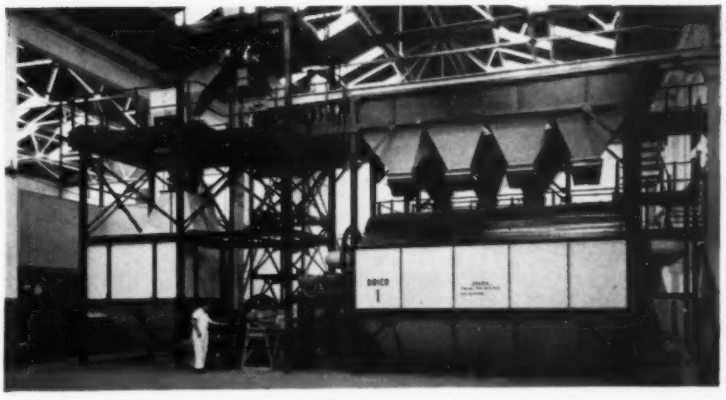
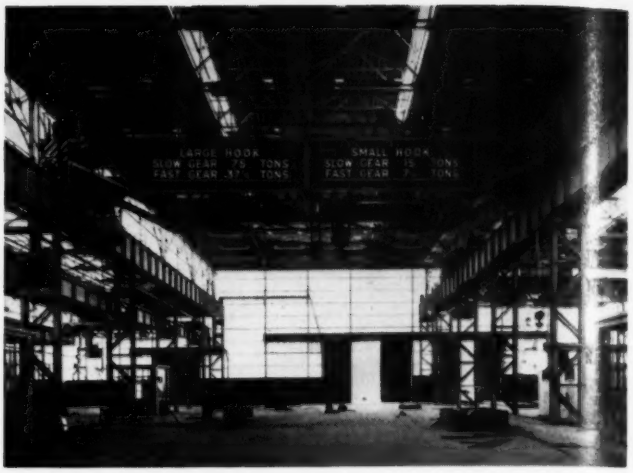


SOUTH AFRICA. *Two Morris 75-ton electric overhead cranes at Rosherville Power Station, Transvaal, shown while the station was under construction.* →



Britische Förder- und Hebegeräte befinden sich in den meisten Ländern der Erde im Einsatz. Seit Kriegsende steigern sich die Verkaufsziffern an ausländische Abnehmer von Jahr zu Jahr. Ein so grosses Ansehen geniessen Geräte britischer Herstellung, dass ausländische Käufer anlässlich der alle zwei Jahre von dieser Zeitschrift in London veranstalteten förder- und hebetechnischen Ausstellungen in Strömen herbeikommen.

In dieser monatlich fortgesetzten Artikelserie werden wir kurzgefasste Einzelheiten und Abbildungen britischer Geräte bringen, welche für das Ausland konstruiert bzw. dort bereits im Einsatz sind.

Ausländische Leser, welche an Auskünften über britische Förder- und Hebegeräte gleichwelcher Art, bzw. an Namen und Adressen der entsprechenden Hersteller, Agenten und Vertreter in irgend einem gegebenen Lande interessiert sind, werden gebeten, sich schriftlich an die Redaktion zu wenden.

NORWAY. *This Conveyancer diesel yard model fork truck is handling coiled wire, using a boom attachment, with the standard forks raised and clamped in position. Chains have been fitted to the front driving wheels, for operation in the snow. The machine has a torque convertor drive, high ground clearance, wide track, articulated rear axle, and wide front track designed to give four point contact on rough ground* ↓

En la mayoría de os países del mundo puede hallarse funcionando equipo británico de manejo mecánico. Desde que terminó la guerra la venta de tal equipo a los compradores de ultramar ha venido aumentando sin cesar. Tan considerable es la estima en que se el equipo de fabricacion britanica en todo el mundo, que son numerosisimos los compradores extranjeros que se personan en Londres para visitar la Exposición de Manejo Mecánico (organizada por esta Revista) que se celebra cada dos años.

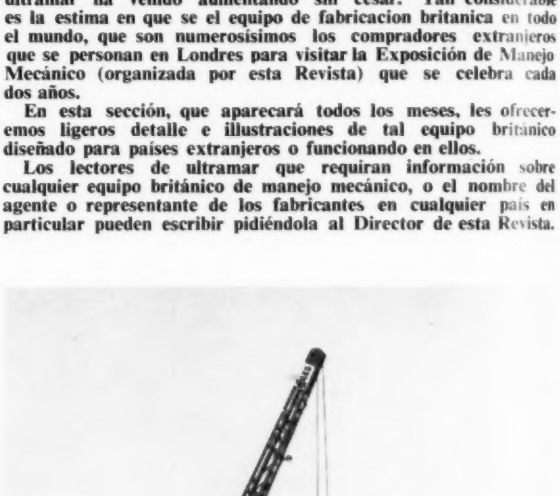
En esta sección, que aparecará todos los meses, les ofreceremos ligeros detalle e illustraciones de tal equipo británico diseñado para países extranjeros o funcionando en ellos.

Los lectores de ultramar que requiran información sobre cualquier equipo británico de manejo mecánico, o el nombre del agente o representante de los fabricantes en cualquier país en particular pueden escribir pidiéndola al Director de esta Revista.

Le matérial britannique de manutention mécanique se trouve en service dans la plupart des pays du monde. Chaque année, depuis la fin de la guerre, le chiffre des ventes à la clientèle des pays d'outremer s'est accru. Des acheteurs de tous les pays du monde accourent aux Expositions de la Manutention Mécanique (organisées par notre publication), qui ont lieu tous les deux ans à Londres, si haute est l'estime que l'on a pour le matériel de fabrication anglaise.

Dans cet article, à suivre tous le mois, nous vous présenterons des détails succincts et des illustrations du matériel anglais spécialement étudié pour et mis en service dans les pays étrangers.

Nous invitons cordialement les lecteurs de l'étranger à écrire à notre Rédacteur en Chef (The Editor) pous tous renseigements concernant un type quelconque de matériel anglais de manutention mécanique, ou les noms de fabricants, agents distributeurs ou représentants dans un pays donné.



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SOUTH AFRICA. *Coles crane model S1210c, seen loading bales of sugar cane to road transport for the owners, The Tongat Sugar Co., Ltd., of Natal. This crane is fitted with scales between the hook and spreader beam to weigh each load before placing it into the truck.*

SHEET METAL GRADER

New Machine for U.S.A.

THE Bren Manufacturing Co., a branch of the R. W. Crabtree organization, has produced a new sheet-metal grader for an American company, the F. J. Littell Machine Co., manufacturers of sheeting lines and other equipment for handling metal in coil. The machine has been ordered for trials in a complete sheeting line of a coil-fed type which is being supplied by the American company to the canning industry.

Up to the time of installation of the Crabtree Grader, the graders being used in these lines are automatic in selection, but the supplying of pallets, positioning, disengaging and unloading are all manual operations. The Crabtree machine is fully automatic and the only manual handling involved is in the removal of loaded pallets. It is also 12-14 ft less in length than the existing graders available in America and the use of housing fabrications has given it a much better appearance.

Although the first Crabtree Grader will probably be supplied in a sheeting line for the canning industry, the manufacturers of the machine envisage much wider applications. Electrolytic tinning lines in the steel industry is one example and it will be of considerable value in production processes involving aluminium sheeting. Aluminium sheets have, in fact, been run through on the grader with success; no end or surface damage has been experienced.

The Crabtree Grader is a two-station machine which, acting on signals, automatically separates prime and reject-sheets and stacks them neatly on pallets. This first machine designed for America is capable of handling sheets of from 18 × 24 in to 44 × 38 in at a maximum rate of 175 sheets a minute and will carry pallet loads of up to 9,000 lb.

The normal operating speed of the conveyor belt is 700 ft/min, but through a p.i.v. gearbox is completely variable from 100 ft/min to 1,200 ft/min. Pallet positioning, hoisting, lowering and ejection in the prime-sheet stacker is fully automatic, the action being dependent upon a pre-set determination of number of sheets on a pallet.

Operation

Sheets are fed to the conveyor by the Littell shear line which has cropped them from coil-strip. At an early stage of conveying, the reject gate is positioned and reject loading is the first stacking station. Within a short distance of this position, there is a mechanism for throwing up single sheets for inspection.

Prime sheets are carried along to the stacking position at the end of the machine and drop between the guides to fall in a natural stacked position on a pallet.

When the pre-set number of sheets has been passed into the stacker, a trip is electrically operated and starts the automatic unloading cycle. Four prongs, moving through the stacker until they are supported by extension bars fitted to the rear of the grader, shoot out from the pile plate and catch the first sheet of the next pile.

The full pallet is lowered until it rests upon the rollers on the floor. The rollers then move the full pallet towards the left and, at the same time, an empty pallet is forwarded on to the revolving rollers. This empty pallet is correctly positioned above the pile beams by retractable stops. When the full pallet is clear of the stacker, the rollers and chain dogs stop, and the pile beam assembly rises, bringing with it the new empty pallet. The hoist is stopped when the empty pallet supports the sheets and the prongs removed from the slots in the top of the pallet. The top sheet is then again kept at a constant height until the next pre-set number of sheets have been counted and the operation is repeated.

When a full pallet has rolled to the end of the ejection

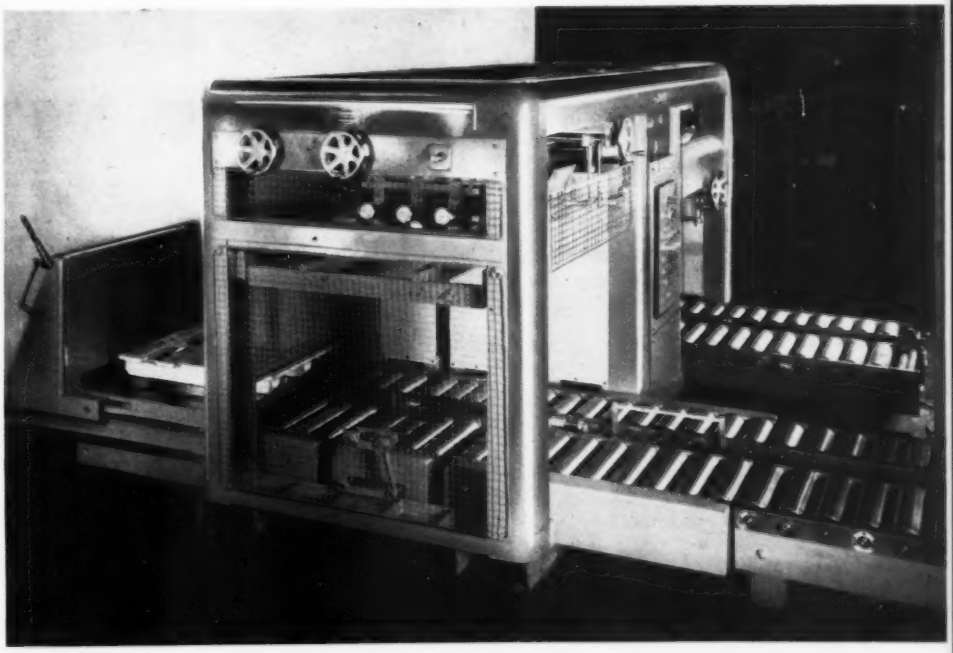


Fig. 1. Three-quarter rear view of the grader. In the foreground can be seen the empty pallet loading arrangement, on the left the motorized section of the discharging section, and, extreme right, the undriven section. The control panel is between the two starting stations

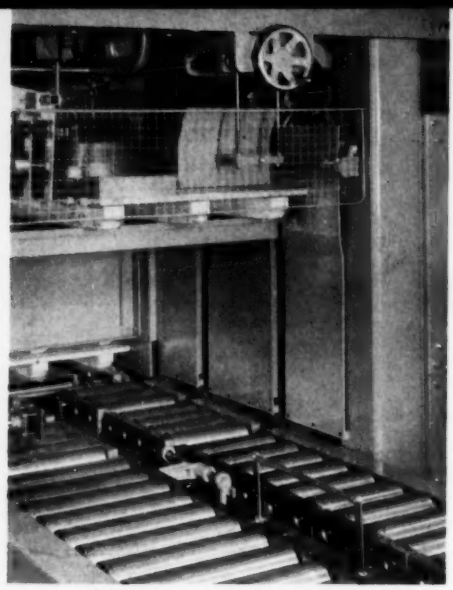


Fig. 2. A general view of the prime sheet stacking station with a pallet in position. To the right of the nearest sheet guide is the photo-electric beam the cutting of which starts the automatic sequence

Fig. 3. The prime sheet stacking station, three-quarters of the way through the automatic unloading cycle. The sheets are being stacked temporarily on three bars until the new pallet reaches them

conveyor it sets off an alarm bell which ceases to ring only when the pallet has been removed. Similarly, a bell gives warning when the last of the empty pallets has been used from the incoming hopper. These audible warnings are supported by different coloured lights which show on the control panel.

Controls

The control panel is linked with the Littell shear line and rejection of sheets is governed by an electronic memory device which passes signals that are based upon a thickness tolerance of $\pm$ 0.0005 in, detection of perforations, and surface condition of the sheeting. This signal electrically operates the rejection gate on the grader under which the appropriate sheet is diverted to the lower conveyor which leads to the reject stacking station.

Photo-electric cells control the height of the prime and reject stacks and start the sequence of electro-mechanical processes which ejects full pallets and replaces with empty ones. Additional push-button arrangements have been made, however, for manual operation of the pallet hoist if required at any time.

From the safety point of view, a pile-up of sheets along the conveyors will automatically shut down the complete line and there are also manually operated emergency shut-down buttons, strategically situated around the machine. A limit-switch also closes down the machinery should for any reason the pile beams rise beyond the pre-set height.

Handwheels on the sides and rear of the Grader provide adjustment for various widths and lengths of sheets. By this means the side guides are moved in simultaneously to ensure that the sheet remains centrally located with the pile beams.

Construction

The Grader is rigidly constructed of cast iron and steel, and ball and roller races have been used extensively to reduce friction to a minimum on all fast-moving parts.

The conveying rollers at each stacking station are of heavy construction with a high degree of finish. The rollers at the prime stacker are driven, with a non-motorized extension from which full pallets can be removed by fork truck. The rollers at the reject stacker are not driven: it is estimated that the maximum number of reject sheets is not likely to exceed 4 per cent and the number of unloadings is therefore unlikely to amount to more than two per shift.

In each stacking station, the pallet for carrying sheets rests on pile beams which are raised and lowered by four revolving screws through gearing by 5-h.p. electric motors. The drive for the conveying belts and rollers and continuous unloading grid is taken from a 3-h.p. electric motor located within the central body of the machine beside the automatic-control mechanism.

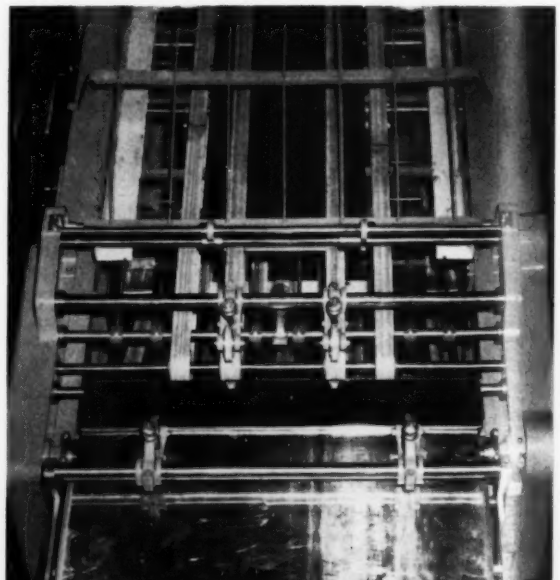


Fig. 4. Top view showing the sheet passing under the reject gate. In the top part of the picture is the rack on to which inspection sheets are thrown at will

NEWS OF PERSONALITIES

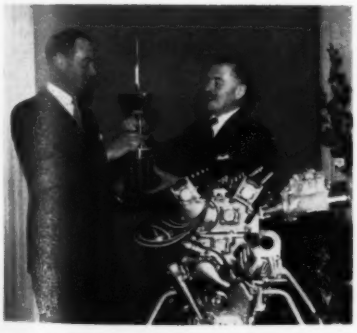
Charles **A. Remfry**, after 35 years' service with Fisher & Ludlow, Ltd., has relinquished his post as managing director of the materials handling division of that company. Mr. Remfry has commenced business as an industrial engineering consultant from 50 Mirfield Road, Solihull, Warwickshire.

C. A. Remfry

Mr. Remfry is well known to readers of this journal and is at present national chairman of the Institute of Materials Handling.

Pye Process Heating announce the appointment of **R. P. Heatley, A.M.Brit.I.R.E.**, as sales manager, from January 1st last.

Coventry Climax Engines, Ltd., whose engines powered Cooper cars, were recently awarded the Ferodo Gold Trophy for the most outstanding British and Commonwealth contribution to motor racing in 1959. **Leonard P. Lee**, chairman and managing director of Coventry Climax



Mr. G. S. Sutcliffe (left) presenting the Ferodo Gold Trophy to Mr. P. Lee (right)

Engines, Ltd., was awarded the trophy at the Dorchester Hotel recently by **Geoffrey Sutcliffe**, chairman of Ferodo, Ltd.

William **Henry Longley** is appointed director and chief accountant of Simms Motor Units, Ltd., with effect from January 1st last.

Mr. Longley, who was born in London in 1929 and educated at Upper Latimer School, lives in Barnet. During the war he served in the Royal Navy on minesweepers from 1940-46 and upon demobilization spent three months on a business training course and one month later joined Simms Motor Units, Ltd., as a management trainee. In 1949, he was appointed assistant cost accountant and in 1952 became material controller, shortly after, in 1953, becoming works and cost accountant. In 1956, he was appointed assistant chief accountant, becoming chief accountant two years later.

Mr. Longley was married in 1943 and has a daughter aged 13 years and a son aged 10 years. His hobbies are squash, sailing and motoring and his interest in the latter is evidenced by the fact that he is a member of the committee of the Simms Motor Club in whose events he is a regular competitor.

W. H. Longley

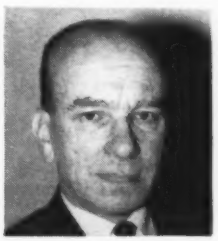
J. C. Wells

J. C. Wells has been appointed chief engineer of the newly formed Baldwin Hydraulic Servo Division, Baldwin Industrial Controls, and the Baldwin Instrument Co., Ltd.

The Fafnir Bearing Co., Ltd., of Upper Villiers Street, Wolverhampton, announce that **G. Marchant** has been appointed general manager of their Wolverhampton and Hednesford factories.

E. H. Brownett, Export Manager, and **R. Eyre**, General Manager, have been appointed to the board of Felco Hoists, Ltd.

E. H. Brownett



R. Eyre

The following alterations to the board of Fred Myers, Ltd., Caterpillar dealer for London and Southern England, have been announced by their vice-chairman, A. N. Dixon.

Peter Hamilton will be joining the company as managing director. Mr. Hamilton has had considerable experience in the sphere of heavy earth-moving equipment, from both American and British sources. He is also well known to the civil engineering industry. Recently, Mr. Hamilton pioneered into this country the introduction of a new range of American construction equipment and materials handling plant.

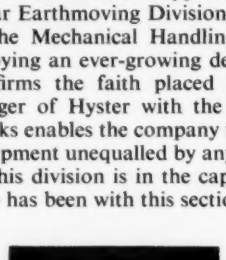
A. N. Dixon

P. Hamilton

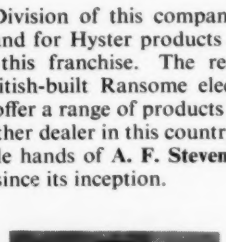
In confirmation of previous reports, Mr. Dixon reaffirms that **D. R. Bowers** is appointed sales manager of the Caterpillar Earthmoving Division.

The Mechanical Handling Division of this company is enjoying an ever-growing demand for Hyster products and confirms the faith placed in this franchise. The recent merger of Hyster with the British-built Ransome electric trucks enables the company to offer a range of products and equipment unequalled by any other dealer in this country.

This division is in the capable hands of **A. F. Stevenson,** who has been with this section since its inception.



A. F. Stevenson



D. R. Bowers

Alan J. Marles, B.Sc., A.C.G.I., A.M.I.Mech.E., has been appointed technical manager of Ransome & Marles Bearing Co., Ltd.

A. W. Kirton has recently been appointed sales engineer to Paterson Hughes Engineering Co., Ltd., covering the South Wales and West Country areas. He will be located at 2 Vicarage Road, Redwick Estate, Pilning, Nr. Bristol, telephone: Pilning 375.

H. M. King

A. W. Kirton

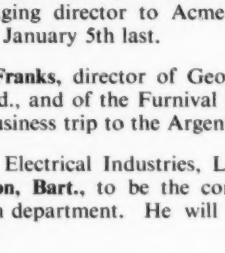
J. Boyd Blakeborough, M.A.(Cantab.), M.I.C.E., M.I.Mech.E., M.I.E.S., M.Inst.Pet., has been appointed joint managing director to Acme Conveyors, Ltd., with effect from January 5th last.

Frederick Franks, director of Geo. Robson & Co. (Conveyors), Ltd., and of the Furnival Steel Co., Ltd., recently left on a business trip to the Argentine.

Associated Electrical Industries, Ltd., have appointed **Sir Arthur Elton, Bart.,** to be the controller of their central information department. He will take up his duties on March 1st.

Hartford M. King, O.B.E., sales director of Geo. W. King, Ltd., has been appointed assistant managing director.

The **Rt. Hon. A. T. Lennox-Boyd, P.C., C.H., M.P.,** has joined the board of P. C. & C. K. Chase, Ltd.



The Rt. Hon. A. T. Lennox-Boyd

A. E. Gregg, Assoc.M.C.T., Assoc.I.E.E., has been appointed a director and general manager of Crompton Parkinson (Chelmsford), Ltd. **A. V. Sowman, M.I.E.E.,** managing director, remains in that capacity.

C. D. Wild has been appointed service manager at the Clay Cross Branch of Bowmaker Plant, Ltd., at Willenhall.

L. J. Tichelly, managing director of Felco Hoists, Ltd., has been appointed to the board of Wheway, Watson & MacLean, Ltd., referred to in Trade Notes, page 176.

C. D. Wild

L. J. Tichelly

April

The above issue will contain the following articles:—

Sequence Control Panel at Sugar Factory

Handling with Industrial Trucks, Part 7

Mechanization at a New Distillery

Skip Hoist Application to Automatic Process Plant

Special Vehicles for Materials Handling and Regular Features

REVIEW OF NEW EQUIPMENT

The Sutcliffe stable hole conveyor with nearside spill plate removed

STABLE HOLE CONVEYOR

Richard Sutcliffe, Ltd., have introduced a new stable hole conveyor for the maintenance of stable holes in advance of the coal face and for the reduction of manpower required to remove coal, etc., at this point. Easily transported, it can be used wherever coal or stone has to be moved short distances in confined spaces.

Designed to use an 18-in wide belt, it is driven at the tail end by a combined electric motor and drive pulley assembly, and at the delivery end by a tensioned return pulley.

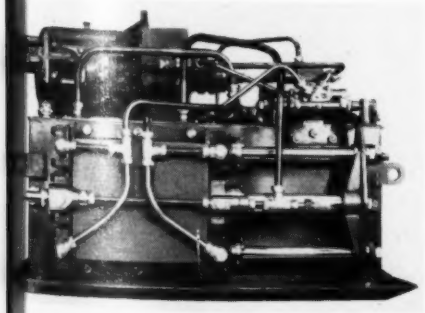
The frame, fabricated from mild steel sheets, forms a trough for the top belt and provides complete protection for the bottom belt. A hopper at the loading end receives the material, and removable spill plates are fitted for the full length of the machine at one or both sides as required. The whole unit is transported by sliding on tubular steel skids. It weighs 6 cwt 30 lb complete and 5 cwt 24 lb without spill plates. The P.V.C. belt is of 3-ply 32-oz Tugron duck with $\frac{3}{16}$-in top and back covers. The belt speed is 175 f.p.m. and its capacity 50 tons of coal per hour. The drum centres are 10 ft plus 3 in adjustment. Other lengths may be arranged to suit varying applications. The overall dimensions are: length, 11 ft 6 in; height, 18 in; and width over terminal box, 2 ft 10 in.

The motor of the driving drum is rated at 2 h.p. at 125 V, 50 or 150 cycles, with remote-control starting. The motor leads are brought out to a junction box fitted with a standard 30-amp restrained-type FLP plug and socket so that the conveyor can be run from a standard drill panel.

DIRECT-ACTING WATER PUMP

Another Sutcliffe development is a direct-acting water pump for use where water is required at high pressure, as for the energization of ramming gear on armoured chain face conveyors, where use is made of mine water to which soluble oil has been added to minimize corrosion. The Sutcliffe pump meets this need and eliminates the cumbersome treble-ram pump. It has as its basis a self-contained power pack in which an electric motor drives a rotary oil pump supplying oil at pressure to a double-acting cylinder, the piston of which is connected to a yoke driving the piston of the water-pumping cylinder. As the oil cylinder is provided with an automatic instantaneous reversing valve, the delivery of water is maintained practically continuously and in unvarying quantity. As the whole of the equipment is mounted on the power pack, movement as the face advances is a very simple operation.

The Sutcliffe direct-acting high-pressure water pump



The pumping equipment consists of a galvanized tank to hold 100 gallons of mixture. On the tank cover is mounted a $7\frac{1}{2}$-h.p. × 1,500-r.p.m. motor which drives a hydraulic oil pump the fluid from which, drives a reciprocating ram. The latter will reciprocate a water ram to give an output of 5 gal/min at 1,000 lb/sq. in. Relief valves and filters are fitted on both the oil and water circuits, and a pressure gauge is included in the water line.

MOBILE TOWER CRANES

Three recent additions to the Coles range of cranes are the Industrious Challenger and Vigorous mobile tower cranes with respective lifting capacities of $2\frac{1}{2}$ tons at 25 ft radius, 3 ton and 5 ton at 30 ft radius. Fitted with the standard 30 ft centres strut jib, they will each lift to a height of 43 ft. Combining mobility, flexibility and manœuvrability in confined spaces with long outreach, good clearance height and driver visibility, the three cranes are basically of similar design with fabricated steel tube tower structure mounted on the superstructure and jib pivot about 20 ft above ground level. They can thus be used for duties outside the range of a normal strut jib crane. The driver's cab is at the top right of the tower at 30 ft from ground to eye level, giving an unrestricted view of the whole working area. The cranes can raise and lower the tower unaided, permitting travel under bridges and overhead wires, or can travel with tower erected, always controlled from the cab on the superstructure and not from that on the tower. A special feature of these machines is their dual application. In less than an hour one can be converted from a tower crane to a normal self-propelled crane with strut jib.

Like others in the Coles range, the new cranes employ diesel-electric power transmission. The engine on the superstructure and coupled to a variable-voltage generator, supplies current to separate motors of the hoist, derrick and for slewing and travelling. Each motion is controlled by an interlocked pair of heavy-duty reversing contactors operated by pilot switches on a console in the driver's cab. Normal routine is to engage the switch for the motion or motions while the engine is running at reduced speed, and thereafter speed of motion is controlled by varying engine speed through the accelerator. Safety features to protect operator, load and machine include automatic limit switches to protect the machine and load should attempts be made to hoist or derrick beyond permitted limits; electro-mechanical brakes, automatically applied to hoist, derrick and slew motions should the current be interrupted; and a safe load indicator, giving audible and visual warn-

The Coles Industrious mobile tower crane, with lifting capacity of $1\frac{1}{2}$ tons at 25 ft radius

ings should attempts be made to lift loads beyond the machine's capacity, automatically cutting the circuits at a predetermined overload. Full-circle slewing in either direction on large double-race ball bearing obviates the need for a centre-post. Travel motion is powered by an electric motor coupled by propshaft to a fully floating driving axle.

Coles cranes are designed, manufactured and marketed by Steels Engineering Products, Ltd., Crown Works, Sunderland.

NEW JONES CRANE

The 10-ton Jones KL 10-10 mobile crane, produced by K. & L. Steelfounders and Engineers, Ltd., Letchworth, has been replaced by a modified version known as the KL 10-10 Mark III, of 12½ tons maximum lifting capacity at 10 ft radius. Like that of the earlier model, its Leyland 0600 125-h.p. diesel engine provides power for the crane motions as well as for travelling. It also has a single cabin, housing both travel and crane controls, designed to be operated by one driver. Whereas the original conventional cab occupied the full 8 ft width of the chassis, that of the new machine is of the fore and aft type offset to the off side. It has two driving positions, one facing forward for travelling and the other facing the rear and equipped with simplified finger-tip crane controls together with duplicate controls arranged as in standard automotive practice.

The crane can be supplied with a strut or cantilever-type jib and the new cabin allows it to be lowered on to a bolster beside the cab, giving a considerably reduced overall travelling height. The maximum lifting capacity is available, using the quickly set up outrigger beams and jacks fitted to the special box-section welded frame. The maximum load that can be handled free on wheels is 7 tons at 10 ft radius. Another important change is the incorporation of a power lowering system as standard by which the braking action of the engine gives smooth and steady lowering at speeds infinitely variable down to a few inches per minute.

The hoisting speeds are 100 ft/min on a single fall of rope, 50 ft/min on two falls and 25 ft/min on four falls, the derricking speed, maximum to minimum radius in 30 seconds, slewing speed, full circle in 24 seconds, maximum travelling speed 30 m.p.h. and weight in travelling order 24¾ tons. Standard jibs are 30-ft, 45-ft and 60-ft sectioned lattice cantilever and 30-ft, 45-ft, 60-ft and 75-ft sectioned lattice strut type. Special jibs can be supplied.

Like all Jones cranes, the new model is distributed in the United Kingdom by George Cohen, Sons & Co., Ltd., Wood Lane, London, W.12.

NEW ELECTRIC STARTERS

Dewhurst & Partners, Ltd., Inverness Works, Hounslow, announce an addition to their range of TF starters. The TKF, non-reversing, and TFW, reversing, models are now available fitted with hand/off /auto switch. This feature is particularly useful in most cases where overriding local control is required in remotely switched electric motors, used in conjunction with automatic switching devices. e.g. humidastats, thermostats, etc.

The latest addition to the range of TF electric starters by Dewhurst and Partner, Ltd.

This starter has many applications in pumping, refrigeration, process control etc. As with others in the TF range, it is fitted with the Dupar ET protector, giving full safeguard against single-phasing or overloading damage to electric motors. It is suitable for direct-on-line operation of A.C. motors in the range ¼ to 7½ h.p.

ELECTRO-MAGNETIC BRAKE MOTORS

The range of electric motors incorporating a disc-type electro-magnetic brake introduced by Newmans Industries, Ltd., Yate, Bristol, has been increased from fractional to 15 h.p. to fractional to 40 h.p. at 3,000 r.p.m. The brakes are suitable for building into any Newmans fractional horsepower and industrial 3-phase motors, drip-proof or totally enclosed, up to 40 h.p., but may not be used for single-phase operation. A torque range of from 3 to 120 lb/ft will eventually be covered.

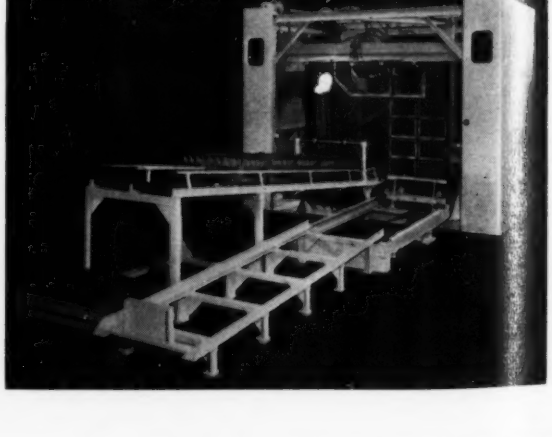
The brakes fitted to motors up to 3 h.p. have sufficient torque to deal with almost all applications. On the larger sizes, however, alternatives are available for each size of motor, one having a retarding torque equal or slightly exceeding the motor full load torque for normal duty, and that of the other not less than 1½ times greater and intended for overhauling loads such as hoists, lifts, etc. In addition to normal horizontal mounting, the motors may be mounted with the shaft vertically up or down.

The new brake motor is standard in every respect, apart from the special non-drive bracket on which the brake is mounted and the shaft extension to carry the brake disc hub. The brake of totally enclosed, fan-cooled motors is mounted

(*Continued on page* 173)

The new Jones KL 10-10 Mk III mobile crane with offset operator's cabin

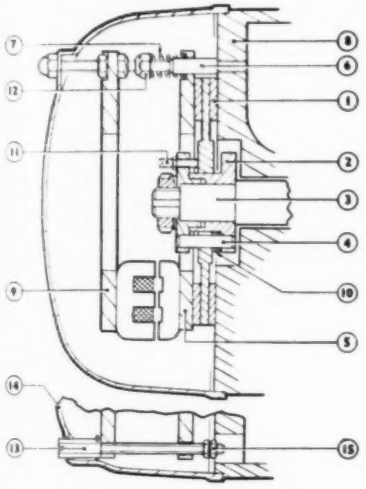
Reduced costs, labour and production time are made possible by the new Gimson pallet loading machine



between fan and motor so that the brake itself, although protected by the cover, is not totally enclosed.

Of the fail to safety type (i.e., energized 'off'), the brake operates direct from a 3-phase supply, and provision is made for manual release when it is de-energized. Since the total movement of the braking mechanism is only 0·02 in, the brake is very rapid in action. It increases the length of the motor but does not project beyond the motor diameter.

Single-disc brake mechanism is shown in the sectional drawing; double-disc brakes are used for higher torque values, but the construction is similar. The cast-iron disc (1) with linings bonded to both sides, is mounted on a steel hub (2) keyed to an extension of the motor shaft (3), at the non-drive end and secured endwise against a shoulder by locknut and tab washer. Drive from hub to brake disc is by four steel pins (4) retained between the hub flanges and on which the disc is free



General arrangement in section of a Newmans single-disc brake motor

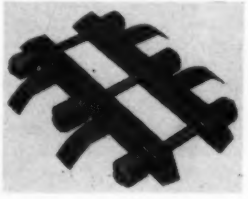
to move endwise. One side of the armature (5) has four laminated cores attached, the other side being used as one of the stationary braking surfaces. The armature is free to move endwise on guide pins (6), and springs (7) clamp the disc between the armature and the non-drive end bracket (8) of the motor, which is suitably machined as the other stationary braking surface. The magnet (9) is a cast-iron plate carrying four special cores and windings and secured endwise on the guide pins by locknuts.

When the magnet is energized, the armature moves against the pressure of the springs to close the gap between it and the magnet, removing the pressure on the disc. Four springs (10) move the disc along the hub until it comes to rest against two set-screws (11) adjusted to centralize the disc between the stationary braking surfaces. There is then clearance, normally 0·010 in-0·012 in, on both sides of the disc and the motor is free to run. Retarding torque can be adjusted, within limits, by altering the clamping pressure due to the springs (7) by screwing back the locknuts (12). Two manual release screws (13), which project through the brake cover (14), are provided for releasing the brake mechanically. These screws are threaded in the magnet plate but pass through clearance holes in the armature plate. Thus, when they are turned several times anti-clockwise, the locknuts (15) eventually pull the armature plate back, releasing the pressure on the disc. The position of the locknuts relative to the armature can be adjusted to give quick release by only a turn or so of the screws, and handwheels can be fitted to the release screws when frequent use of this facility is required.

LOW-LOADING TROLLEY

Though designed principally for the transport of heavy cylindrical loads, the new 6-wheeled low-loading trolley produced by Powell & Co., Burry Port, Carms., South Wales, is also suitable for carrying heavy crates, safes and similar loads, as well as for carrying and manœuvring steel plates or sheets held in a vertical position.

The trolley departs from the traditional design by utilizing the recently available rectangular section hollow steel tubing for the main frame members. A saving in



A hollow steel frame is a feature of the Powell lightweight six-wheel low-loading trolley

weight is thereby effected without reduction in load capacity.

Two sizes are in production, one 24 in long and 20 in wide, with a capacity of 4,000 lb, the other 30 in long and 20 in wide and of 3,500 lb capacity. The trolley is only 3½ in high, and the centre wheels are of larger diameter than those at the ends, so that the trolley pivots easily and can be turned in its own length. All wheels are of solid steel and fitted with alloy steel roller bearings.

GAS-DRIVEN CONCRETE MIXER

Practical advantages of using Calor gas as an engine fuel are reduction of engine wear and tear, 100 per cent combustion without oil dilution or cold starting difficulties and reduced number of oil changes. These are obtained by the use of the gas-driven version of the 4/3 Mini-Giant concrete mixer manufactured by Frederick Parker, Ltd., Viaduct Works, Catherine Street (Extension), Leicester. The fact that the noxious fumes given off by the gas engine are considerably less than those from a petrol-using unit will be appreciated by contractors engaged on indoor work. Previously for indoor operations electricity and compressed air have been used to drive mixers. The portability of these machines, however, is limited as they can be used only where electricity or compressed air is available. The gas-driven mixer has no such draw-

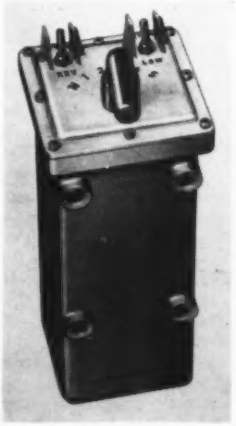
The Calor Gas-driven Parker Mini-Giant concrete mixer

back, because the gas cylinder is fitted to the machine.

A conversion set for gas power on the Mini-Giant mixer consists of a 10-lb gas cylinder holder, gas cylinder, a combined regulator and atmospheric valve, a gas-air mixing chamber and special exhaust pipe. The guarantee of the Villiers engine installed is unaffected by the use of gas instead of petrol fuel. Conversion sets for Petter and Lister engines used for the Parker Little Giant concrete mixer range will also be available in the near future.

EASIER TRACTOR TRANSMISSION CONTROL

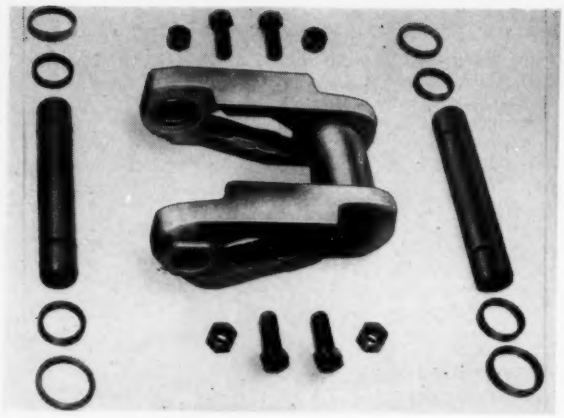
Designed to meet the demands of heavy earthmoving service, the new Synchro-Touch control has been introduced by the Caterpillar Tractor Co., Peoria, Illinois, U.S.A., as optional equipment for the Caterpillar DW20 and DW21 tractors. It



The SynchroTouch control unit introduced as optional equipment for Caterpillar DW20 and DW21 tractors

permits operators to change gear up or down by merely dialling a desired gear range instead of performing the usual operation required by standard direct-drive transmissions.

Control is by a gear selector to the right of the operator at arm level. The standard



Items which make up the Bowman track link repair kit

Improved version of the Lindars electro-pneumatically operated material flow control slide

clutch pedal is retained, but used only for starting from rest. The only change in the direct-drive transmission is replacement of the shifter shafts, forks, shaft brackets, transmission covers and shifting linkage by the SynchroTouch device. With this in place the shifter shafts become pistons housed in hydraulic cylinders. Hydraulic pressure is supplied by a vane-type pump at the rear of the engine, driven by the timing gear. Action of the hydraulic system is controlled electrically, actuated by the operator's selector switch. The operator dials the gear selected, which disengages the master clutch by air pressure. The shifting collar is then hydraulically disengaged, putting the transmission in neutral. If the operator is changing up, the shifting collars are automatically brought to approximately the same r.p.m., and hydraulically shifted into place to accomplish the gear range change. Air is then exhausted from the clutch roto-chamber, permitting the clutch to re-engage. When changing down, the governor control reduces the rack to the low-idle position, creating a momentary reversal of power through the transmission, during which time the down change takes place. The clutch pedal is used only when changing from neutral to a gear range from standstill. This safety feature eliminates the possibility of an operator setting the machine in motion by inadvertently manipulating the gear selector.

TRACK LINK REPAIR KIT

For the repair of the various tracks employed on Caterpillar crawler equipment Bowmaker (Plant), Ltd., Noose Lane, Willenhall, Staffs, are now offering complete track link repair kits. They comprise links, two master pins and bush groups, nuts and bolts that will enable an operator to carry out a repair to a damaged link on the job, thereby saving valuable operating time. They are available at all Bowmaker branches.

ELECTRO-PNEUMATIC MATERIAL FLOW CONTROL

Lindars Automation, Ltd., 143 Maple Road, Surbiton, have developed an improved version of their range of electro-pneumatically operated slides for material flow control. The units are of mild steel, complete with air cylinder, solenoid-operated air valve, open- and closed-position detection switch and an air release valve for emergency hand operation and maintenance.

The design precludes the possibility of jamming by the elimination of guides, the slide plate bearing on rods when mounted beneath conveyor outlets, and on rollers when mounted at bin or mixer outlets. Easy fixing is ensured by its double-flanged construction.

Six standard sizes range from 4½ in × 4½ in to 18 in × 18 in, and they are available as single units or as part of complete control installations. Special sizes and fully dustproof versions are also available.

MOLYBDENUM DISULPHIDE IN ACTION

The important advantages afforded by the use of molybdenum disulphide, MoS_2, as a dry lubricant, particularly under high pressures between mating surfaces, in a very wide field of applications to the use and production of machinery and equipment are comprehensively emphasised in a new booklet issued by K. S. Paul (Molybdenum Disulphide), Ltd., Angel Lodge Laboratories and Works, Angel Road, London, N.18. They are well substantiated by reports of a large number of actual users, arranged under 14 technical headings, the majority of which concern both users and manufacturers of mechanical handling machinery and equipment. These relate to the value of MoS_2 in preventing thread seizure and welding at high temperatures, for extreme pressure solid lubrication, running-in bearings, lubrication of conveyors operating under adverse conditions, prevention of 'stick-slip' and sticking of mating surfaces, dry and semi-dry lubrication, as an anti-scuffing, anti-seize, anti-fretting medium, production engineering and other applications.

It is pointed out that MoS_2 is a mineral mainly found in altered granite, and its purity is of prime importance if used for lubrication. The amount contained in rock is only between ¼ and ¾ per cent. The remainder consists mainly of silica, ferrous and non-ferrous impurities, mostly abrasive, the absence of which cannot be over-stressed. As a lubricant, therefore, MoS_2 must have a purity of 98·5 per cent. Its particle size, it is stated, is also of great importance. If too large, it may not be held by the surface asperities or may be filtered out in a circulating oil system. On the other hand, to reduce particle size by dry grinding or similar methods tends to oxidize them so that MoS_2 becomes MoO_3, molybdenum trioxide, which has no lubricating properties.

Molybdenum disulphide, it is explained, consists of a layer of molybdenum atoms between two layers of sulphur atoms. The bond between molybdenum and sulphur is extremely strong, but between two neighbouring sulphur layers very weak and easily sheared. The outer layers have a natural tendency to adhere to metal surfaces. These characteristics, together with the formation of an adsorbed layer, and in certain cases the reaction between the MoS_2 and the surface, create an impregnated surface layer of great inherent lubricating value, capable of withstanding stresses greater than the yield strength of the majority of bearing materials. Among other properties, the bearing capacity of MoS_2 is given as over 400,000 lb/sq. in., melting point above 2,200 deg F. and coefficient of friction in powder form 0·05 to 0·09.

IMPROVED HYDRAULIC RAM

Important advantages are claimed for the improved hydraulic ram for face conveyors developed by Richard Sutcliffe, Ltd., Horbury, Wakefield. The ram cylinder is made from solid-drawn tubing, the bore being smooth-honed to size, prolonging the life of the packing and seals. The piston rod is ground to size and electrolytically coated with hard chrome to increase the life of the rod and packings and eliminate corrosion. Synthetic fabric reinforced seals with polished rods and honed cylinder eliminate leakages, making it unnecessary to fit a high-rate pump.

The control valve is independent of the ram and is mounted on the adjacent gobside plate. Made from high-grade iron casting, the valve body is fitted with a polished hardened steel rotary piston on well-tried plug principles. The seals are drained and there are no plastic plates to wear. The valve has three positions, ram out, neutral and ram in. In neutral the

(*Continued on page* 175)

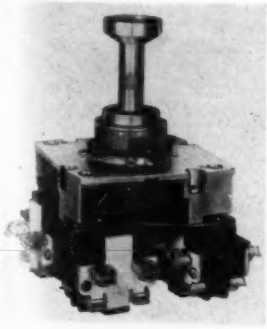
Hydraulic ram with independent control valve developed by Richard Sutcliffe, Ltd.

ram can be disconnected without loss of oil, leaving the system undisturbed. The valve may be fully housed in a channel section attached to the gobside plate. It is unnecessary to provide a special gobside plate as the channel section is drilled to accept both the ram and control valve, and may be fitted on any section along the conveyor. The channel can accept the ram in three positions, an advantage beneficial to prop-setting in relation to the ram.

JOY STICK CONTROL UNIT

A further extension to their range of oil-tight heavy-duty control units by the addition of a four-position lever-operated type is announced by Square D, Ltd., Cheney Manor, Swindon. Designated Class 9001, Type TX joy stick operator, it is actually four push-buttons in one unit. Where it is essential to assure operation of only one push-button at a time, joy stick control finds its application. With this new unit a machine operator, without moving his hand from one push-button to another, can perform four operations by means of a single lever. It is available as either a momentary or maintained contact operator, with or without an off-position latch. Mechanism in the handle requires depressing before allowing movement of the operating handle.

Each operating position of the handle has a correspondingly numbered latch bar. Individual latch bars can be removed, allowing the handle to be moved from the centre or off position to the operating position correspondingly numbered without the operator having to depress the release pin in the handle which operates the off-position latch. Any of the operating lever positions can be changed from momentary to maintained contact by moving the lever pin from the first to second slot. This conversion can, of course, be reversed.

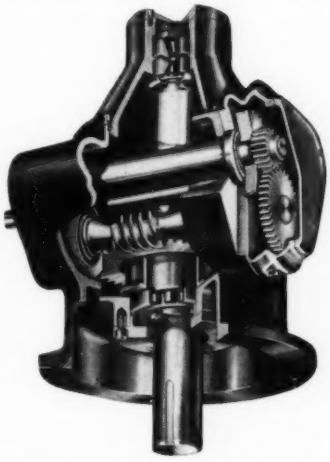


The latest heavy-duty joy stick control unit introduced by Square D, Ltd.

MIXER DRIVE UNITS

A new range of gear drive units, specially designed to suit agitators and mixers, has been developed by the Highfield Gear & Engineering Co., Ltd., Karrier Works, Huddersfield. With these the output speed can be changed to suit any mixer speed over a very wide range by 'pick-off' gear assembly. Horsepower ratings are available for any desired output speed, calculated in accordance with the capacity of the gears, heat dissipating capacity of the cases and churning losses.

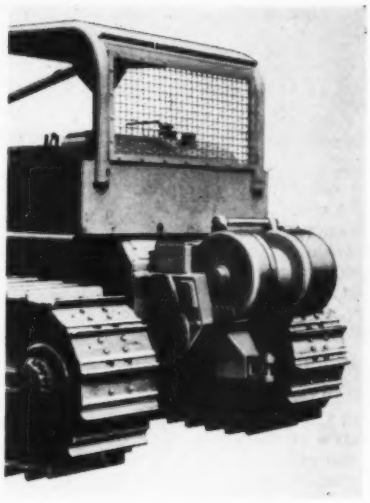
The output shaft is larger in diameter than in the standard gear units, eliminating the fear of bending the shaft. The bearings are correspondingly larger, with a roller bearing to take heavy journal loads, and thrust bearings to withstand heavy thrust loads in either direction. Dry-well construction on the final shaft eliminates oil leakage. The motor can be foot- or flange-mounted, but standard horsepower ratings allow for the heat-dissipating action of the motor fan. The range covers three sizes of drives to give up to 62 h.p.



Showing the detail design of the Highfield mixer drive unit

CRAWLER TRACTOR TOWING WINCHES

New design features are embodied in the latest Hyster D6C towing winch production of the Hyster Co., P.O. Box 328, Peoria, Illinois, U.S.A., for mounting on Caterpillar D6 tractors and No. 977 Traxcavator. Available in Standard and Lo-Speed models, it replaces the old D6N towing and worm-driven winches. Easier shifting and longer control cable life are ensured by a constant-mesh transmission, utilizing a jaw clutch engagement spring to take the shock out of shifting. Gear arrangement has been simplified and all gears are of special heat-treated alloy steel, while a high-speed reverse cuts the time to pull out cable. New brake and clutch levers are similar to the tractor master and steering clutch levers and are located for easy operation. The Lo-Speed winch provides line speeds as low as 23 ft/min for jobs requiring high pulling power and low speed and a high-speed reverse is also a feature. Optional equipment includes a free spooling group for converting the standard winch, cable guide rolls, fairlead and automatic brake.



The power-controlled Hyster D89A towing winch mounted at the rear of a Caterpillar tractor

Another Hyster development is a new power-controlled towing winch for installation on Caterpillar D8 and D9 tractors. Featuring a hydraulic control system, the D89A winch is available in standard and Lo-Speed models. Only power-controlled winches can be used with D8 and D9 power-shift tractors. It can be installed on Series D Caterpillar D9 tractors and Series D through H tractors in the D8 line, with either direct or torque converter drive transmissions.

Redesigned controls, convenient to reach and operate, require only 8 lb of effort, compared with up to 50 lb on former models. A single lever provides automatic brake release while engaging clutches, and an inching brake gives precise control when lowering a load. A gear-type hydraulic pump is driven by the tractor lay-shaft. Winch transmission oil, screened through a vacuum-type filter, is used in the hydraulic control system actuating a pair of multiple-disc oil-cooled clutch units that require no adjustment. The self-energizing differential brake requires infrequent adjustment.

The power-controlled winch can be operated at any time the tractor is running, independent of the tractor clutch, allowing winching while the tractor is moving and permitting the load to be dropped and retrieved without stopping. For high line pulls and low line speeds for precise movement of extremely heavy loads, the power-controlled D89A Lo-Speed winch is available. Optional equipment includes guide rolls and fairlead assembly and a choice of standard, fixed or swivelling drawbar.

TRADE NOTES

British Tractors for Pakistan

An order for 88 Challenger diesel crawler tractors has been placed with John Fowler & Co. (Leeds), Ltd., by the Pakistan Government. The order, worth almost £350,000, was obtained against world-wide competition, including American, Italian, French, German and Russian tractor manufacturers.

This is the largest number of crawler tractors ever ordered in a single contract by the Pakistan Government, and follows upon 10 years' experience in this market, during which period over 300 Fowler crawler tractors have been put into service in the territory and have been operated by Pakistan personnel under some of the worst conditions of climate and terrain to be found anywhere in the world.

The tractors, which will be fitted with Marshall hydraulic angledozers, will be used for land reclamation, road making and irrigation work by the Department of Agriculture.

John Fowler & Co. (Leeds), Ltd., are members of the Marshall Organization, with headquarters at Gainsborough, Lincolnshire. The tractors are all to be built at their Hunslet works in Leeds.

The Engineering Industries in Europe

The above is the title of a booklet recently issued by the Machinery Committee of I.E.E.C. and is published by the Organization for European Economic Co-operation 2 Rue Andre-Pascal, Paris, XVIe.

Wheway, Watson & McLean, Ltd.

In December, 1959, Job Wheway & Son, Ltd., Green Lane, Walsall, amalgamated with Watson & McLean, Ltd., Harmony Row, Glasgow. Previously, Mechanical Equipments, Ltd., St. Paul's Street, Leeds, had been purchased. The three companies will continue to operate under their own names, but have become subsidiaries of a holding company known as Wheway, Watson & McLean, Ltd., with registered offices at Green Lane, Walsall.

The three subsidiaries will continue to manufacture their full range of products, which include electrically welded steel chains and the manufacture, testing and repair of all types of lifting tackle.

Change of Address

Rhoden Partners, Ltd., design and development engineers in mechanical and production engineering, have recently removed from Park Crescent, London, W.1, to larger premises at 19 Fitzroy Square, London, W.1. Tel.: EUSton 9696.

£150,000 Crane Control Orders

During the first two weeks of this year, Brookhirst Igranic, a Metal Industries subsidiary, has received from the steel industry orders for crane controls valued at more than £150,000.

Newest order, worth £50,000, is from Colvilles, Ltd., and is for 14 sets of magnet crane controls; these controls will operate with crane equipments being built for Colvilles by Sir William Arrol & Co. and George Russell & Co.

Perkins Engines Secure Order from United States

Orders for 1,430 Perkins 1·6-litre Four 99 marine and industrial diesel engines, totalling about 700,000 dollars, have been received by Perkins Engines, Ltd., from the United States. They include further substantial orders from the Transicold Corporation, of Los Angeles, for engines for use in reefer mobile refrigeration units.

Perkins Engines, Ltd., has also received orders for 230 Four 99 marine diesel engines from customers on the Pacific and Atlantic coasts. Deliveries of these engines have already started and most of them are to be installed in fibreglass or plywood launches and runabouts.

£2,000,000 Order for Mitchell Engineering

The mechanical handling department of Mitchell Engineering, Ltd., have been awarded a £2,000,000 contract by Richard, Thomas & Baldwin, Ltd., for mechanical handling equipment for their new Spencer Steelworks at Llanwern, near Newport.

The contract, one of the largest awarded for mechanical handling plant in Great Britain, covers ore and coal screening, crushing and conveying machinery and storage plant. Work on the contract has already started and is due to be finished by March, 1961. Apart from the mechanical handling plant, Mitchells are also installing coal blending equipment, driers for the home ores and storage plant for approximately one million tons of ore and 80,000 tons of coal. This plant will be designed to handle foreign ores at the rate of 1,200 tons per hour, home ores at 1,200 tons per hour and coal at 800 tons per hour.

When the steelworks are completed in September, 1961, they will produce 1,400,000 tons of steel a year.

Australia Launches World Trade Fair

It is announced that the International Sydney Trade Fair will be held from August 1st to 12th, 1961. Sydney is to be the venue.

Richard Green, Ltd.

The above manufacturers of lifting equipment of all kinds have recently opened an extension of their factory at Cradley Heath, Staffs. This will enable them to increase considerably the capacity of their lifting tackle repair and retesting service.

New Service Depot

A new service depot for London and the Home Counties has been opened at Barking, Essex, by the British materials handling division of the Yale & Towne Manufacturing Co. Providing an immediate spare parts service to all Yale industrial truck users, the depot is well equipped and is staffed by Yale fitters specially trained for carrying out routine servicing and component repairs.

The opening of this depot marks a further extension of the facilities offered by Yale & Towne's mobile service fleet, in line with the company's policy of continually improving its service to the customer.

The full address of the depot, which is

(*Continued on page* 177)

Seven Bray tractor shovels, valued at £27,000 *lined up ready to be sent off to the docks for shipping to Sweden. All seven are ordered by one Swedish agent, indicative of the Swedish attitude to these British machines which compete in Sweden with American as well as Sweden's own machines.*

The biggest machine, on the right, the BL460T, will lift 12,000 *lb and is powered by a* 110 *h.p. Leyland deisel engine*

New Yale & Towne Service Depot, Barking

Part of the production line of Robotug driverless trolleys, at the Hayes plant of E.M.I. Electronics, Ltd., where large numbers of battery-operated trucks are being fitted with electronic guidance control systems for use by railways, warehouses and leading manufacturing organisations in this country and overseas.

Each trolley has a control unit, into which an operator can programme the necessary instructions, to make the trolley call at up to 75 different points for loading or unloading. Arrangements can be made to call at more points if desired. When restarted at the last of these, the trolley automatically returns to its original destination.

One of the chain conveyors of the log handling plant recently installed by the Mechanical Handling Department of Mitchell Engineering, Ltd., at Bowaters' Mersey Division Pulp and Paper Mill at Ellesmere Port, Cheshire. The complete plant has a total of 1,250 ft of chain belt for carrying the logs either straight to the pulping mill or to a reserve pile. The plant is capable of handling over 100 tons of logs an hour

open from 8 a.m. to 6 p.m. on weekdays and from 8 a.m. to 12 noon on Saturdays, is: The Yale & Towne Service Depot, Ripple Road South, Barking, Essex. Tel.: DOMinion 5945.

Air-Dust Vacuum Systems, Ltd.

A company, Air-Dust Vacuum Systems, Ltd., has been registered with sales offices at 1 Egerton Road, Streetly, Staffordshire, Tel.: Streetly 2372, under the direction of J. B. Stribling.

The equipment manufactured utilizes low air volumes in pipes of small diameter to convey a variety of materials ranging from foundry sand to sawdust. Conveying rates of 5 tons per hour in a 3-in dia pipe are claimed, and larger tonnages can be handled in larger diameter pipes. Systems can be designed for either pressure or suction, and pressure differentials up to 10 lb/sq. in. are used. Materials handled can be in powder form, and granular and small lump material can be conveyed. Designs are available for 'sticky' or abrasive materials.

Plant Extensions for S.A.V. Hydraulics

To help keep pace with the ever-increasing demands for hydraulic components for incorporation in machine tools, mechanical handling equipment, tractors, earth-moving equipment, road vehicles and a host of other machinery—S.A.V. Hydraulics have embarked on a programme of factory extensions. At Chessington, near Kingston, Surrey, and at Bedhampton, near Havant, Hampshire, extensions are well advanced. Each will add some 10,000 sq. ft. of productive floor space and will, when completed and in operation, cut delivery times considerably.

During the past two years offices have been opened at Birmingham, Leeds, Manchester and Glasgow so that these important centres have on-the-spot technical advice, sales and service facilities.

S.A.V. (Stein Atkinson Vickers Hydraulics, Ltd.) build and distribute in Britain the Vickers Detroit hydraulic components. This range is built to a common specification and is available in most industrial countries—in each of these countries a complete spare parts and servicing organisation is readily available, if required.

Weldall & Assembly, Ltd.

Weldall & Assembly, Ltd., announce that an important agreement has been concluded between the company and Fried Steel Equipment Manufacturing Corporation of New York. Licensing arrangements have been granted to Weldall & Assembly, Ltd., steel fabricators and conveyor specialists in Great Britain (and a member of the Triplex Safety Glass Group) who will manufacture and sell Fried units on a world-wide basis with the exception of the Americas and Canada.

Fried Steel equipment, designers and manufacturers of material handling equipment have developed and patented the Fried 'Liftveyor' and Fried Strip Stacker, highly specialized material handling equipment for sheet and plate squaring shears.

Vaughan Crane Co. in India

The Vaughan Crane Co., Ltd., of West Gorton, Manchester, 12, announce that they have formed a joint venture company in conjunction with Messrs. Burn & Co., Ltd., of Howrah, West Bengal, and Messrs. Martin Burn, Ltd., of Calcutta, India, to manufacture mechanical handling equipment, including overhead electric and hand-operated travelling cranes and hoist blocks. The new company is The Vaughan Burn Crane Co., Private, Ltd., Martin Burn House, 12 Mission Row, Calcutta, 1. P.O. Box No. 28.

Investment in French Company

Elliott-Automation announce that negotiations are proceeding with Manufacture de Machines Due Haut-Rhine S.A. ('Manurhin') of Mulhouse, France, with a view to arrangements being made for the manufacture in France of automation equipment.

Manurhin is an old-established engineering business with large manufacturing plant at Mulhouse and in other parts of France. It is proposed that Elliott-Automation will take a financial interest in Manurhin.

B.S. Handbook No. 4 : Lifting Tackle

This revised edition of B.S.I.'s popular Handbook No. 4 (Part 1) will be welcomed by all whose work calls for an authoritative and up-to-date reference source on the subject of lifting tackle. Prepared at B.S.I.'s request by Mr. L. Linder, M.I.Mech.E., one of Britain's foremost lifting tackle experts, the publication is the first of two parts. Part 2, Chains and Fittings, is expected to be published shortly.

Overseas Developments of Teleflex

Teleflex Products, Ltd., of Basildon, Essex, have recently appointed agents to cover their sales areas in the Middle East and Portugal.

Mapplebeck, Ltd., of Beirut, Lebanon, are the agents appointed to cover the Middle East and Henriques Barbosa & Sibra, Ltd., of Lisbon, are the agents for Portugal.

Simms Chosen in International Talks

A signal honour was paid to Simms Motor Units, Ltd., when they were chosen by the Ministry of Labour as one of the two commercial firms in the country to be visited by an important industrial deputation from Italy.

The 5-day programme arranged by the Ministry of Labour for a joint employer-worker team from Rome, Milan and Turin, included visits to the Ministry itself, the Trades Union Congress, the British Employers' Federation, the Engin-

The above picture shows the stand of Hugh Wood & Co., Ltd., at the 'War on Want' exhibition which was held recently at the Central Hall, Westminster. The object of the exhibition was to draw attention to the need for raising living standards throughout the world and only a limited number of firms, each individually representative of a different branch of industry, were invited to take part

Pollard 'Self-Lube' pillow blocks and take-up bearing units are fitted to the main conveyor leadshafts at Gatwick Airport

eering and Allied Employers' National Federation, the National Institute of Industrial Psychology and the Department of Social Science at Liverpool University. However, the Government thought it important that the deputation, which is investigating management-worker problems from an international standpoint, should have discussions with a really up-to-date manufacturing organization as well, and a visit to Simms Motor Units, Ltd., took place.

New Depot Opened

The Leverton group of companies announce that their new South Yorkshire depot, Meadowbank Road, Rotherham, opened for business on December 1st last. Leverton's Rotherham depot will be managed by Alex Gibbins, late of Tarslag, Ltd., who recently returned from a tour of Caterpillar dealers in the United States.

Introduction to Industry

The 'Introduction to Industry' training courses are again available to boys taking 'A' level science subjects, at the Chippenham works of Westinghouse Brake & Signal Co., Ltd. Two courses are arranged for next month.

These courses give a good insight into the engineering industry, its training facilities, and future prospects. Travelling expenses are allowed to any boys living more than five miles from the works, and lodging expenses are given to those from farther afield. Mid-day meals are also provided. Applications should be sent to the personnel superintendent at Chippenham works before March 18th.

Forward Discharge Elevator

John King & Co. (Leeds), Ltd., Garnet Road, Leeds, 11, have acquired the sole manufacturing rights of the forward discharge elevator patented by Mr. Norman Jones and the Preston and District Farmers Trading Society Ltd.

In Mr. Jones's invention the main characteristic lies in a pivoted platform which, when arriving at a displaced portion of the upward track, is free to swing downwards thus discharging its load in a forward direction. Not only does this avoid any crushing of the sack, but the load is deposited gently and smoothly which is important in the case of fragile materials. From this it will be gathered that any type of bulk load apart from sacks can be handled by this elevator.

A further important point is its speed of operation. No longer is this related to the time taken for a sack to fall through the elevator as in the old crossbar type, but higher speeds and closer spacing of loads are possible, thus for a given number of loads per hour, one forward discharge elevator will do the work of two old-type elevators. Both single and multi-storey buildings can equally be served by this elevator.

J. H. Fenner in South Africa

S. B. Hainsworth, chairman and managing director of J. H. Fenner & Co., Ltd., has announced the formation in Johannesburg of J. H. Fenner & Co. Africa (Pty.), Ltd., which plans, in conjunction with Messrs. Reunert & Lenz, Ltd., the manufacture of a range of mechanical power transmission goods in the Union.

'Self-Lube' at Gatwick Airport

The baggage-conveyance system now operating at Gatwick Airport is considered to be the most highly efficient in the world to-day, linking closely with road and rail arrival points.

On arrival at the passenger-reception kiosks all luggage is weighed and then placed on a special floor conveyor situated directly behind the luggage weighing machines. This conveyor carries the baggage to the Customs area, thence to the ground-floor assembly area. Here the baggage is loaded on to vehicles for transportation to the runway. A similar system is used in reverse for incoming baggage. These facilities allow air travellers to make their way to and from the aircraft unhampered by baggage from the moment they arrive at the airport.

As loading begins only 20 minutes before take-off, it will be appreciated that hold-ups on the conveyors caused by congestion or breakdowns must not happen. To avoid congestion or overloading a standby conveyor adjoins the main system. This secondary conveyor can be used either to relieve or supplement the main conveyor.

In order to reduce conveyor maintenance time and to eliminate stoppages caused by breakdowns, the conveyor manufacturers, The Lamson Engineering Co., Ltd. London, incorporated 'Self-Lube' bearing units, manufactured by Pollard Bearings, Ltd., for extensive use on both the inward and outward systems. Every 'Self-Lube' self-aligning ball-bearing unit is packed during manufacture with the correct amount of highest-grade grease and then sealed for life by means of the specially designed Pollard Dual seals. No further lubrication of the bearing is necessary throughout its entire life.

New R.T.B. Steelworks

A contract to the value of rather more than £500,000 for the design, manufacture and erection of the Wagon Marshalling and Unloading Equipment for Ore, Coke and Coal, has been awarded to Strachan & Henshaw, Ltd., Bristol, by Richard Thomas & Baldwins, Ltd.

The equipment which will be installed at the new Spencer Works at Newport, Mon., will comprise four 50-ton wagon tipplers with automatic weighbridges and dust-suppression equipment, together with Beetles and Hydrabrakes for remote control of marshalling operations necessary to handle all incoming raw materials.

The first stage will be put into operation by June this year and the remainder of the system by July,1961.

Agreement with Unit Crane & Shovel Corporation, U.S.A.

Steel & Co., Ltd., has made an agreement with Unit Crane & Shovel Corporation, of Milwaukee, U.S.A., whereby Unit will manufacture Coles cranes in Milwaukee

(*Continued on page* 179)

and will market these through U.S.A., Canada and Mexico under the name of Unit-Coles, and R. H. Neal & Co., Ltd., will manufacture Unit cranes, excavators, draglines and backhoes in Grantham and will market them throughout the world with the exception of U.S.A., Canada and Mexico under the name of Neal-Unit, and subject to the existing Unit franchises in Australia, Union of South Africa and the Benelux countries.

A sales company has been registered under the name International Crane & Excavator Corporation with headquarters in New York for marketing Coles cranes and Unit cranes and excavators in the South and Central American Republics.

New Standard of Service for Fork Lift Trucks

From the fork-truck user's point of view, the most important part of the supplier's organization is the Service Department. This emphasis on service arises from a very simple fact, that whenever capital equipment is out of action for overhaul or repair, it is losing money for its owner, or, at the very best, failing to make an expected profit. Recognizing this, Matbro Limited, manufacturers of fork lift trucks and earthmoving equipment, have made provision since moving to their new Horley factory for service and spares supply which, it is claimed, even the most exacting customer finds to be outstanding.

The maximum use is made of Ford service, with its world-wide system for supplying spares at low, fixed prices, and the main features of the new Matbro services are:—202 Fordson dealers in the United Kingdom (and others all over the world) provide spares and service for the engines, axles, gearboxes, clutches, steering gear, etc. used in Matbro fork lift trucks and earthmoving equipment; in addition, Matbro service vans operate from the factory; every Fordson dealer employs factory-trained mechanics and service vans for on-site work; many of these dealers also carry Matbro hydraulic spares, and new Matbro-Fordson dealers are appointed frequently; "Enfo" spare parts, prices and labour charges are fixed at the lowest level and backed by Ford skill and experience; the "Enfo" parts-exchange scheme enables all Matbro owners to exchange certain parts when they require overhaul for similar parts reconditioned to Ford "good as new" standard; every machine carries Matbro and Ford guarantees.

From Gatwick Airport, only 10 minutes away, the new Matbro service stores can air-freight spares for machines to any part of the world, delivering to Gatwick within half an hour of receiving a telephone call or cable. The factory also has its own railway siding for freight, and is situated close to Horley main-line station, with its fast passenger-train service.

S.A.V. Hydraulics School

Special two-day courses organized by S.A.V. Hydraulics (Stein Atkinson Vickers Hydraulics, Ltd.) have proved so popular that the number is to be doubled in 1960. Courses will be held once fortnightly and the programme will include three types of course:—

1. An introductory technical course for designers, draughtsmen and others who wish to acquire a basic grounding in hydraulics.
2. An advanced technical course for those familiar with hydraulics but requiring a deeper knowledge of up-to-date circuit technique.
3. A service course for maintenance engineers.

The courses are free and are open to all who wish to apply. The numbers attending each course, however, are limited to 25 so that those attending have the maximum opportunity of studying exhibits and of asking questions. Lecturers will also be available to attend engineering societies, universities, technical colleges and large commercial organizations, if desired.

Applications should be addressed to:—Hydraulics School, S.A.V. Hydraulics, 197 Knightsbridge, London, S.W.7.

A New Mackay Depot in the North

As distributors for two of the world's largest manufacturers of earthmoving equipment, Allis-Chalmers and Fiat, Mackay Industrial Equipment, Limited, announce the opening of their northern depot at Wheatley Hall Road, Doncaster.

This depot will maintain full field service and the supply of parts for all Allis-Chalmers and Fiat earthmoving equipment, Mackay DAC.130 compressors and Allis-Chalmers solids handling pumps.

The installation of the Telex service will be a welcome facility to many of their customers.

The full address of Mackay's new depot is: Wheatley Hall Road, Doncaster, Yorkshire. Telephone: Doncaster 66353. Telex: 5667.

PUBLICATIONS RECEIVED

Parker Plant News

Frederick Parker, Ltd., Catherine Street, Leicester, have issued the January, 1960, number of the above publication, which gives details of the company's recent activities.

Barimar, Ltd.

The above company, of 22/24 Peterborough Road, London, S.W.6, have issued an illustrated booklet which shows a wide range of machinery apparently only fit for the scrap heap, as well as less badly damaged parts and worn components, all of which have been repaired at comparatively low cost by scientific welding.

George Angus & Co., Ltd.

These manufacturers, of 152-158 Westgate Road, Newcastle-upon-Tyne, 1 have issued a companion booklet to their Industrial Protective Clothing booklet, dealing with the protection of the hands and arms, which features items of protective clothing for the body. Also available is a booklet, 'Conveyor and Elevator Belting'.

Films

Massey-Ferguson (Great Britain), Ltd., of Banner Lane, Coventry, recently published their new film catalogue which gives details of films available from their film library.

Groundhog Gazette

A special 75th year commemorative issue of the Marion Groundhog has been issued by the Marion Power Shovel Co. of Marion, Ohio, U.S.A.

Trucks for All Purposes

Geest Industries, Ltd., White House Chambers, Spalding, Lincolnshire, have produced an illustrated leaflet describing their full range of models. Abridged List No. TA.459.

Clyde Crane and Booth, Ltd.

This company, of Rodley, Leeds, have issued a new brochure describing their Hydraul-Luff level luffing cargo cranes which feature hydraulic luffing of the jib.

The Digger

The above publication, dated autumn, 1959, gives details of the latest developments and activities of Ruston-Bucyrus, Ltd., Lincoln.

British Productivity Council

Twelve case histories are included in a booklet entitled 'Raising Productivity in Smaller Firms'. Copies are available, price 2s. 6d., from the British Productivity Council, 21 Tothill Street, London, S.W.1.

Fuller Airmerge System

The Fuller Co., of Catasauqua, Pa., U.S.A., have produced a Bulletin B.2, giving details of the above system. Copies are available from Constantin (Engineers), Ltd., 123 Victoria Street, London, S.W.1.

Henry Simon (Holdings), Ltd.

The above company, of Cheadle Heath, Stockport, have recently published a brochure in connection with Simon hydraulic platforms, which are manufactured by Simon Engineering (Midlands), Ltd., Dudley, Worcestershire. The new brochure gives complete technical and operational details of the whole range of machines.

Monsanto Mail No. 4

Monsanto Chemicals, Ltd., of 10-18 Victoria Street, London, S.W.1, have produced a lavishly illustrated booklet with various articles of scientific interest.

W. J. Jenkins & Co., Ltd.

This company, of P.O. Box No. 3, Retford, Nottinghamshire, have recently issued a leaflet entitled 'Teska', detailing their dense medium washer.

Flexibox Mechanical Seals

Flexibox, Ltd., of Nash Road, Trafford Park, Manchester, 17, have published a new comprehensive mechanical seal catalogue which describes the full range of Flexibox balanced and unbalanced

mechanical gland seals for all types of rotary shaft equipment—pumps, mixers, agitators, compressors, etc. Copies are available from the public relations department.

Link-Belt Co.
Information on industry's most complete line of helical gear speed reducers is contained in Book 2751 recently published by the above company. Entitled 'In-Line Helical Gear Speed Reducers', copies are available from the company at Dept. PR., Prudential Plaza, Chicago, 1, Illinois, U.S.A.

Elcontrol, Ltd.
This firm have recently produced a new data sheet, OR/UR, which describes current overload and underload relays. Copies are available from Elcontrol, Ltd., Wilbury Way, Hitchin, Hertfordshire.

Turner Bros. Asbestos Co., Ltd.
To commemorate the inauguration of their new factory at Hindley Green, the above company have recently published a brochure which details briefly their growth and future development.

Goodyear Industrial Rubber News
The December, 1959, issue of the above publication is now available from the Goodyear Tyre & Rubber Co., Ltd., of Wolverhampton.

Crofts (Engineers), Ltd.
Two extensive brochures are available from the above company, of Bradford, 3, detailing Crofts radiation combined spur and worm double-reduction gear units, and also their ½-in-pitch range of Power-Grip timing belts.

The Journal of Applied Pneumatics
Vol. 3, No. 22, 1959, and Vol. 3, No. 23, 1959, of the above journal, distributed by Martonair, Ltd., of Parkshot, Richmond, Surrey, are now available.

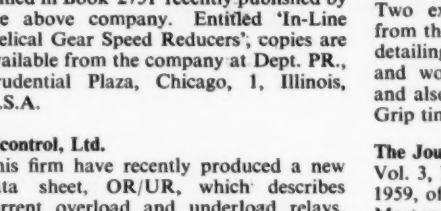
Enchiridion
The above publication has recently been issued by Firth-Vickers Stainless Steels, Ltd., Sheffield. In this issue are shown a few examples of the many applications of stainless steel in the domestic and industrial fields.

The New Henderson Derrick Crane
John M. Henderson & Co., Ltd., of King's Works, Aberdeen, have produced a booklet entitled as above, illustrated in colour, describing the Henderson derrick cranes.

Rapid Magnetic Machines, Ltd.
This firm, of Lombard Street, Birmingham, 12, have published a new leaflet, No. 123R, entitled 'Magnetic Overband Separators'.

Herbert Morris, Ltd.
The latest book on Morris electric cranes, known as Section 10, 2nd Edition, is now available from the above company at Loughborough, Leicestershire.

Ransomes & Rapier, Ltd.
Three new catalogues are obtainable from the above company, of Ipswich, entitled 'Concrete Mixers and Water Pumps', 'Engineering Products', and 'What We Make'.



ABSTRACTS AND REFERENCES

Articles on mechanical handling published in all technical and industrial journals of the world are indexed and abstracted below. Whenever it is known, the published price of the journal containing the article is given.

The addresses of the publications concerned are given and applications for copies of the journals mentioned should be made direct.

MECHANICAL HANDLING FOR STORAGE
Deciding the Purchase of Fork-Lift Trucks. By Major R. T. Price. *Storage*. 1 Stamford Street, London, S.E.1. December, 1959. Pp. 34-37. 2s. 6d.

In this article the author suggests a possible approach to the problem of buying fork lift equipment for storage handling. The procedure he advises is first to consider and analyse the task to be performed. The next step is to consider alternative methods of handling and whether palletization can be adopted efficiently in view of the building layout, ceiling heights, obstructions, dimensions of doorways, approaches and exits, access for vehicles, despatch and receipt facilities and inclines to be negotiated. Various questions relating to the use of pallets are discussed, including the cost of introducing fork lift trucks. Much valuable advice is then given upon the type of equipment which would be most suitable, and the features which should receive special attention.

THROWER CONVEYOR
Conveyor Belts Fling Solids up to 80 ft. *Design News*. 3375 S, Bannock, Englewood, Colorado, U.S.A. 7 December, 1959. P. 25.

A Dutch method of conveyance described utilizes two endless rubber belts, the surfaces of which are in contact with each other. They are driven at linear speeds of up to 1,200 ft/min, forming a versatile throw conveyor. The upper belt is mounted on springs and hydraulic shock absorbers to permit passage of large lumps. The lower belt projects in the direction of throw. The whole assembly, with hopper, is mounted on a 2-wheel vehicle. Materials fed from the hopper are ejected in a continuous jet. It is aimed by operation of a hydraulic jack which sets the belt centre line to an angle between 10 and 50 deg with the horizontal. Adjustment of belt speed also varies the throw of the conveyor. Bulk materials in sizes varying from powder to 7½-in lumps can be thrown over 30-ft obstacles and up to 80 ft at rates up to 150 tons/hr.

RAM WITHOUT FLUID
Electrical-Mechanical Ram. *Design News*. 3375 S, Bannock, Englewood, Colorado, U.S.A. 7 December, 1959. P. 91.

A device is described as duplicating the operation of a hydraulic ram without use of the usual fluid with its attendant leakage, freezing, boiling and sealing problems. It uses an unusual 'fluid', consisting of a quantity of steel balls which are transferred from one end of a cylinder to the other by means of an electric motor-rotated screw in conjunction with a longitudinal slot. The balls act upon a piston which in turn moves the ram. To reverse the direction of the ram, the motor is simply reversed by means of a switch.

HANDLING TELEPHONE SETS
Electronic Sorting Makes Shipping Simple. *Factory*. 330 W. 42nd Street, New York 36 N.Y., U.S.A. December, 1959. P. 111.

A high-speed electronic sorting system, conveyors for handling cartons and automatic pallet-loading equipment are described as working together to streamline the handling of 100 tons of products per day at the Western Electric Company's Indianapolis plant. An overhead belt conveyor carries telephone sets in coded cartons from the manufacturing area to the merchandizing building. It discharges them on to a spiral gravity conveyor which acts as a buffer to reduce speed of the cartons so that they are spaced about 40 in apart on a high-speed sorting belt. On this they pass in front of a battery of electric eyes which react to reflective tape on each carton and actuate deflecting units that route the cartons to one of eight conveyors leading to packing stations. Eight spiral conveyors carry cartons of phones, each of one type, to eight packers who send full cartons up inclined belt conveyors to eight accumulation-controlled live roller conveyors 12 ft above floor level. Each accumulation conveyor has controls to indicate where a pallet load is

available. Additional controls shut off the motor if the accumulation conveyor is completely full. A special console regulates the carton flow to a pallet loader, and by means of pilot lights and push-buttons, the attendant can select the line ready for pallet loading. By a system of roller and belt conveyors the cartons are taken into gluing and compression equipment. They are then received by the automatic pallet loader which arranges them on a pallet in a pattern selected by the operator at the console. Peak capacity exceeds 40 cases per minute.

FOR CLEANING CONVEYOR BELTS
Versatile Belt Cleaner. *Modern Power and Engineering.* 481 University Avenue, Toronto 2, Canada. December, 1959. P. 83. 50c.

A spring-type conveyor belt cleaner described is said to be the result of years of experiments and tests with power-driven brushes, beaters, water sprays, air jets and scrapers. Originally developed to clean wet, sticky coal from high-speed conveyor belts, it consists of a row of thin spring steel wiper blades, each with an individual pressure spring. The blades are set perpendicular to the belt surface but diagonal to the travel of the belt. Pivoted connections between blades and springs permit the wiping edges of the blades to seat uniformly on the surface of the returning belt. As the belt passes, each blade wipes a path clean and dry. As the blades overlap, the entire carrying surface is wiped clean.

SELF-CLEANING BUCKET
Front Loader Bucket. *World Construction.* 22 West Maple Street, Chicago 10, Illinois, U.S.A. November, 1959. P. 46.

Savings in time and labour as well as using loader bucket capacity to the best advantage are benefits attributed to a new front loader bucket. It is fitted with a heavy steel blade that scrapes the bucket clean from top to bottom each time it dumps a load. It is available in capacities of 1 to 2¼ cu. yds.

SOLID NYLON TYRE
Tyre is Laminated Vertically. *Material Handling Engineering.* 812 Huron Road, Cleveland 15, Ohio, U.S.A. December, 1959. P. 109. 75c.

Reference is made to a vertically laminated nylon tyre, with no air chamber, for lift trucks, front-end loaders, tractors, cranes and other machines. It is said to be absolutely flat-free, undamaged by jagged stones, scrap metal, brick or glass. It is made of fabric parts banded together with rubber and an internal steel band under tremendous pressure. This ensures a soft, bounce-free ride and tyre life usually greater than the machine to which it is fitted.

KEEPING BOTTLES UPRIGHT
Magnetic Handling. *Automation.* Penton Building, Cleveland 13, Ohio, U.S.A. December, 1959. P. 74.

For filling, testing and capping bottles on a continuous production line, an American company, it is stated, have adopted a magnetic handling method of keeping the bottles upright and steady during processing. They are placed in individual fixtures made from plastics or aluminium, with an iron metal ring inserted in the base. At the end of the production line the bottles are removed for packaging, and the fixtures are transferred back to the head end of the line by an inclined magnetic belt conveyor.

TWO-TON TYRE
The World's Largest Tyre. *The Australasian Engineer.* 20 Loftus Street, Sydney, Australia. October, 1959. P. 65. 7s. 6d.

An illustration is given of a Goodyear tyre, made in America, for use on large earthmoving vehicles and construction equipment. It is 10 ft in diameter, has a 4-ft wide tread and weighs 2 tons. A 32-ply tyre of this type will, it is stated, carry 30-ton loads at speeds up to 35 m.p.h.

RECENT PATENTS

ROLLER FRAME
Etablissements Richier, of France.—U.K. 787550.

Re-issued amended patent improvement on 667205 for varying ballast on road roll so that load on wheels can be altered as desired, using a rectangular shaped section running from high up in front to lower down near rear.

CONVEYOR ROLLER
McNolly Pittsburg Manufacturing Co., of Kansas.—U.K. 797825, re-issued amended.

A flexible cable is used, with journal sleeves coaxial with the idler rollers, but preventing the cable rotating.

DUMP TRAILER
E. A. Schonrod, of Texas.—U.K. 799092.

Patent re-issued amended, for a dump semi-trailer with aid to breaking angle of repose during initial title so that less power needed, by having pivoted lift arms operated by cables.

LIFT JACK
Brockhouse & Co., Ltd., of West Bromwich.—U.K. 817338.

A simple stable lift device for cars, etc., using a given form of base and trunnion.

PNEUMATIC JACK
Regie Nationale des Usines, of Billancourt.—U.K. 817373.

Just issued (five months late and with false dates). Design with hollow rod and cylinder which is small and handy for use in workshop load handling, by means of a differential somewhat as per patent 815971.

CIGARETTE HANDLING
S.A.S.I.B. Spa., of Bologna.—U.K. 817487.

A handler design for cigarettes, just issued months late, with wrong date, for discharge mechanism from a conveyor into collecting box, using a suction pick-up, i.e. for filling cigarette boxes.

LOAD HANDLER
Société Civile d'Etudes Pour Materiel, Seine.—U.K. 817546.

A pivoted gripping arm device for accurate positioning of objects, e.g. as a transfer device, having swing dampening arrangements.

BOTTLE SPACER
Geo. J. Meyer Manufacturing Co., of Wisconsin.—U.K. 817550.

A feed device for labelling, filling, etc., bottles, somewhat as per patent 805074, which uses a rotary helix of increasing pitch to give uniform spacing whether square or circular cross-section bottles are used, i.e. whether their bottoms touch or not.

ROLLER CONVEYOR
Sheepbridge Stokes, Ltd., of Chesterfield.—U.K. 818901.

Of cheap construction with bearing in rubber block, using given form of spindle and flange which avoids much machining of the cast roller shape.

ANIMAL HANDLING
P. P. Bagshawe, of Matlock.—U.K. 819829.

Pivoted apparatus to raise cattle hind quarters or legs, e.g. of cows, where slings are unsuitable, using tackle on frames which can be closed together, e.g. by a screw to fit the pelvic girdle.

MINE CAGES
Qualter Hall & Co., Sales, Ltd., of Barnsley.—U.K. 819874.

A centralizing device outline to ensure rail register by using angle guides against the cages, with vertical rubbing tails and pivot rail levers.

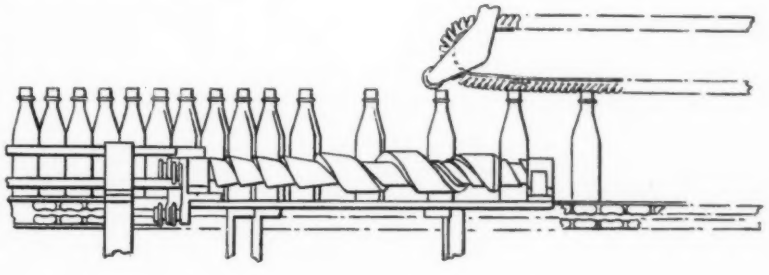
ASH CONVEYANCE
John Thompson & Co.—U.K.'s 819904/5/6.

A belt conveyor design running in a trough of water, somewhat as per patent 545137, is mentioned for ash quench, etc., with sludge collecting pockets to avoid undue wear, spaced at, say 60ft, intervals, and avoiding plough plate wear by using rubber lined bearer supports as well as on the conveyor belt bottom by the flow water which technique also avoids sludge collection.

CYLINDER HANDLING
James Halley & Sons, Ltd., West Bromwich.—U.K. 819917.

Printing cylinder moved on a carriage

No. 817550 *Feed Spacing Device*



running on rails or track to avoid bother of lift tackle and manhandling problems.

REFUSE COLLECTION
J. Ochsner & Cie A.G., of Zurich.—U.K. 819926.

Patent 297962 is mentioned and equipment outlined using refuse bin with hinged lid feeding a cart having a moveable hood of given action.

BOTTLE HANDLING
Solar Engineering & Equipment Co., Pennsylvania.—U.K. 819949.

Mechanical handling device for ensuring registration during printing, achieving orientation by holding bottom in a chuck, with a finger reaching into lugs or notches.

TRANSFER MACHINE
Leading Engineering & Manufacturing Co., of Michigan.—U.K. 819950.

Factory transfer machine for gear making, which avoids damage and acts as a store, comprising a drum mounted in a cylindrical rotating shell with a helical track to accept the parts.

DIGGER
General Motors Corporation, of Detroit.—U.K. 819954.

An articulated digger bucket machine, with better stability on hills and manœuvrability, having front and rear drive.

ASSOCIATED ILIFFE TECHNICAL BOOKS

Books Recommended by

'MECHANICAL HANDLING'

ELECTRIC-MOTOR CONTROL GEAR, Starting, Protection and Speed

J. L. Watts, A.M.I.E.E. 5s. By post 5s. 8d.

ABACS OR NOMOGRAMS

A. Giet, translated and revised by J. W. Head, M.A.(Cantab.), and H. D. Phippen, M.A.(Edin.), B.Sc. (Lond.). 35s. By post 36s.

MATERIAL HANDLING IN WORKS STORES, SECOND EDITION: The Fork Lift Truck and Pallet System

L. J. Hoefkens. 18s. By post 19s.

PRINCIPLES OF MASS AND FLOW PRODUCTION

Frank G. Woollard, M.B.E., M.I.Mech.E., M.I.Prod.E., M.S.A.E. 25s. By post 26s. 4d.

PRODUCTION ENGINEERING: Practical Methods of Production Planning and Control

J. S. Murphy, A.I.I.A. 12s. 6d. By post 13s. 5d.

PROGRESS IN CARGO HANDLING, VOL. II

63s. By post 64s. 9d.

Obtainable from all booksellers or direct from

THE PUBLISHING DEPT.
DORSET HOUSE
STAMFORD ST., LONDON, S.E.1

REACTOR GRAB
U.K.A.E.A., of London.—U.K. 819966.

Lift device for retrieving fuel elements, etc., deep down in narrow channels in reactors, say 40 ft away, using flexible cable.

OVERHEAD CRANE
Électricité de France, of Paris.—U.K. 819981.

Underground crane for hydro-plant, etc., use which avoids pillar supports, so it can work near the walls and roll from an arch near the roof ledge.

PALLET CARRIER
Carrimore Six Wheeler, Ltd., of London.—U.K. 820055.

Lorry, etc., with tailboard loading, hinged as a platform with a conveyor chain inside the vehicle.

LINKED PLATE SYSTEM
Clarke Chapman & Co., Ltd., of Gateshead.—U.K. 820069.

Continuous trough conveyor using sprocket chains and inter-engaging, overlapping troughs with perpendicular sides.

CONCRETE ELEVATOR
R. M. Bolt, of California.—U.K. 820105.

Mortar, etc., mixer and elevator using screw mixing, bucket mounted on a tractor, hydraulic operated and needing no conveyor to the mixer bucket.

TOW HOOK
Loveridge, Ltd., of Cardiff.—U.K. 820109.

Rapid-release design with spring-loaded latch and pull-actuated cables.

GRANULE FEED
Corning Glass Works, New York.—U.K. 820155.

Feed and mix of glass, etc., materials into a hopper and thence out on to a conveyor.

EARTH MOVER CONTROL
Collins Radio Control.—U.K. 820189.

Blade setting controlled for bulldozers, etc., by electronic methods.

TUNNEL KILN
S.I.T.I., of Italy.—U.K. 820220.

Conveyor of reduced thermal capacity which avoids wear by using rollers cooled by fluid, all driven by external sprockets of silicon carbide or stainless steel.

STACKER TRUCK
Martlings, Ltd., of Wolverhampton.—U.K. 820228.

Pallet and stillage lift of straddle type with adjustable legs to avoid overbalance yet give motion in any direction.

LINK CONVEYOR
AB Valida Maskiner, of Sweden.—U.K. 820303/4.

Automatic discharge at pre-set places, using round link chain with support blocks. Suited for box carried parts, e.g. radio assembly.

HOPPER WAGON
Waggonfabrik Talbot, of Aachen.—U.K. 820389.

A self-discharge rail wagon high enough in the middle to allow lorries, etc., to pass under, but having containers in this space during transit.

FORK TRUCK
Clark Equipment Co., of Michigan.—U.K. 820390.

Improved hood slinging arrangement to give easier maintenance access.

BOTTLE FEED
Morgan Fairest, Ltd., of Sheffield.—U.K. 820433.

Labelling, etc., device working over a straight path whilst bottle upright, at high flow rates, or filling, or corking, etc., using a pivoted link chain parallel to one side of the conveyor, with interchangeable jaws for different article sizes.

ROLLER SPINDLES
Fisher & Ludlow, Ltd., of Birmingham.—U.K. 820514.

Improvement on patent 754340 for cheaper conveyor roller spindles, made from resilient metal with a slit in it, e.g. mild steel plate.

JOINTED PLATES
H. Knaust et alii, Germany.—U.K. 820552.

Conveyor with central round link chain drive and rollers on belt able to traverse curves without undue strain, using ball joints or similar.

TRUCK HANDLING
Preparation Industrielle des Combustibles, Fontainebleau.—U.K. 820558.

Rail truck tippling arrangement with smooth and accurate stoppage under auto control, using a hydraulic motor for the pair of creepers.

MULTI-STOREY GARAGE
L. W. Piazolo, of Dortmund.—U.K. 820559.

Made from prefabricated and interfitting section, with spiral ramps, cheaply so it can be dismantled and used again, with its bifurcated main joists.

INVALID LIFT
Ted Hoger & Co., Inc., of Wisconsin.—U.K. 820597.

U-base with spreadable side portion in the design, having an apex post and swinging carrier arms, supported by hydraulic arms.

TUBE VALVE
Procea Products, Ltd.—U.K. 820714.

Patent 803992 is improved for a pipe or conduit flow control of granules, etc., via a rubber sleeve or tube insert and deformers pivotally mounted.

TEA CRUSHING
W. A. Kerr, of Kenya.—U.K. 820726.

Improved rubber crushing roller using conveyor feed and given form of oscillating sieves or screens.

CONVEYOR SERIES
T. & T. Vicars, Ltd., of Newton le Willows.—U.K. 820731.

Bread handling for slicing, cooling or wrapping, with set of conveyor some being pivoted to give diversion if needed to go round jam or trouble point.

PITCH COOLING
Scottish Agricultural Industries, Ltd., of Edinburgh.—U.K. 820750.

An easy, cheap cooling technique for pitch, using a water-sprayed belt conveyor, fed from a rotating drum which dips into a trough of water.

STACKING TRUCK
G. S. Jinks, of Leicester.—U.K. 820781/2.

Fork truck with lift platform lateral between ends, supported on four steerable wheels, for use in narrow gangways having no springs between wheels and frame to avoid canting trouble.

POSITION INTERLOCK
Woodall Duckham Construction Co., Ltd.—U.K. 820958.

Interlock control for coal bunker, chute, charge car, etc., correct positioning with horizontal coke ovens, quarries, blast furnaces, etc., using a gamma-ray beam.